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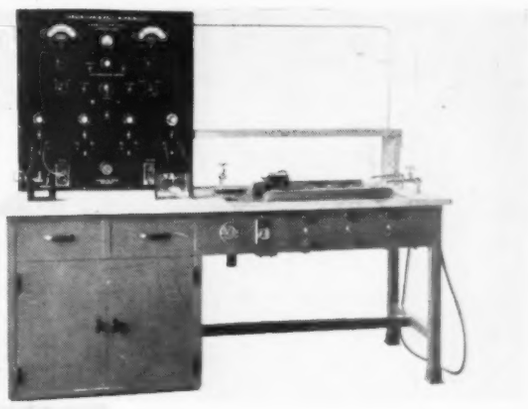

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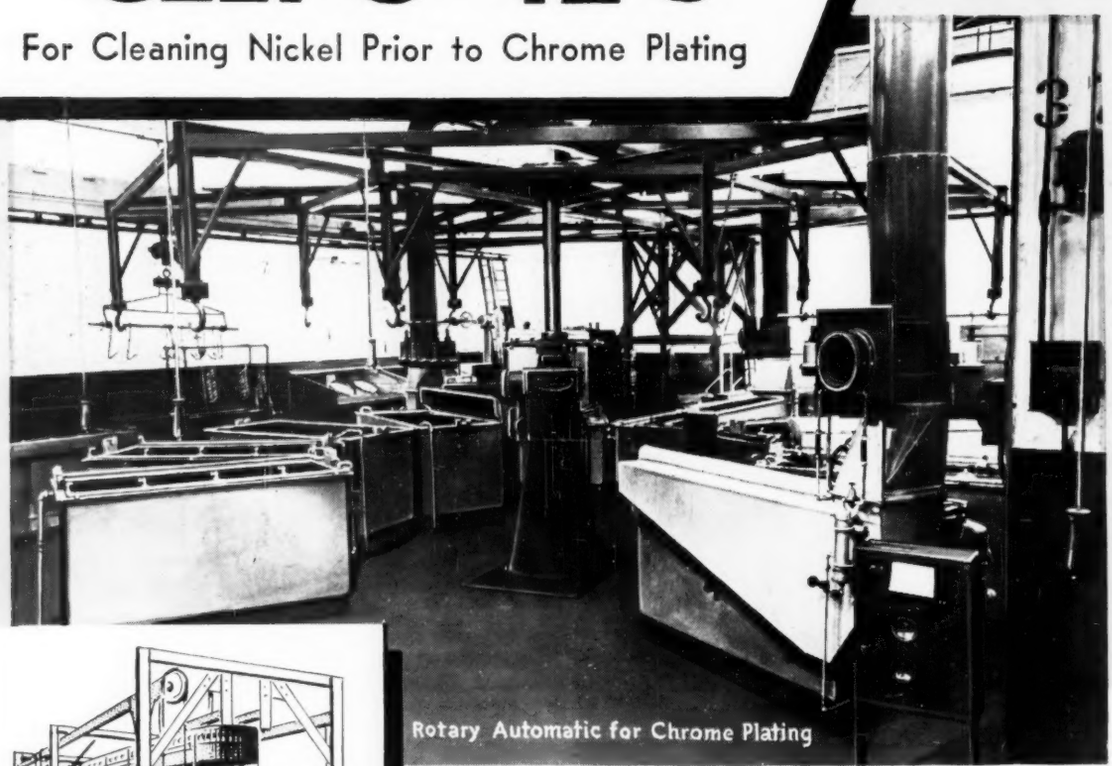

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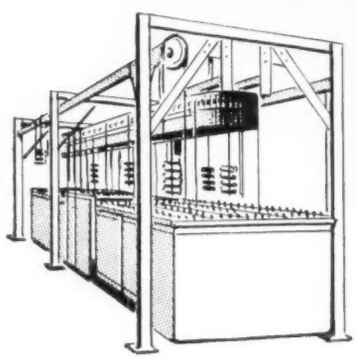

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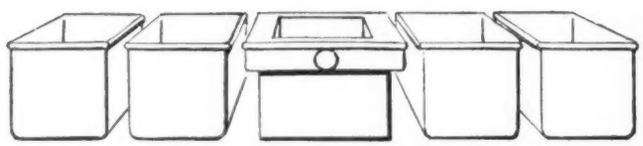

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Founded as Metal Industry, January, 1903 by Palmer H. Langdon, 1868-1935

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COMING SOON

Requirements and desirable properties of electrodeposits; ductility, corrosion resistance and crystalline structures.

•

Simplified methods of testing for various plated coatings with a minimum amount of equipment and technical assistance.

Discussion of equipment and processes required for practical anodizing installation.

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Bibliography of books, articles and patents, with comments on each, of nickel alloy deposition in the literature.

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VOL. 44, NO. 9 METAL FINISHING SEPTEMBER, 1946
PREPARATION, ELECTROPLATING, COATING

A Way Out

With increased labor costs, OPA termination and its resulting higher raw material prices, the Finishing Industry is faced with the problem of maintaining the competitive price line without sacrificing quality and service. Particularly is this true in the plating field, where reconversion to pre-war services is extremely costly and not yet complete.

A way of dealing with this problem in the plating room lies in a piecework system on finished parts. Relatively few platers believe that incentive in a plating room is practical; however, years ago the same thinking was held in the polishing and painting departments. Since that time, polishing and painting methods have been standardized, hand motions analyzed and improved, operations time studied and rated; until now daywork is the exception.

Similarly, plating room techniques should be analyzed and adapted to incentive methods. Overhead is a constant cost per hour; direct labor cost is the varying factor in a basic production price. Obviously, if the production rate is doubled, the overhead is cut in half, thus maintaining the price line without affecting profits, or labor and material costs.

The industry should place a hurry-up call with the industrial engineering groups to develop a competent incentive plan for that finishing pivot, electroplating. Many plans have been tried and the majority have been found wanting; as a result platers, especially job-shop men, have been left with a bad impression of incentive systems. However, with the rapid strides made in time and motion study together with the host of incentive systems developed during the war, there is every reason to believe a satisfactory bonus plan could be developed for each plating shop in the industry.

We must rid ourselves of the plating room piecework bugaboo if we desire a way out.

Plating Bath Characteristics

By H. J. SEDUSKY and J. B. MOHLER

Research Chemists, The Cleveland Graphite Bronze Co.

IF ONE had never plated from any bath other than a chromic acid bath and then suddenly began to use an alkaline tin bath he would be: pleased by the high throwing power obtained, irked by stop-offs that refuse to stand up, annoyed by behavior of the anodes, and displeased with the decomposition of the bath. Yet he would find that the alkaline tin bath resembled the chromic acid bath in some respects. Both baths:

1. Evolve gas at the cathode,
2. Increase in plating rate with increase in current, and
3. Increase in plating rate with increase in temperature.

Although both baths increase in plating rate with increase in current, the cathode efficiency increases in the chromium bath (with increase in current) while the cathode efficiency decreases in the tin bath (with increase in current).

Both baths have particular characteristics and both baths have something in common with all plating baths. All plating baths require:

1. An anode,
2. A cathode,
3. A conducting medium to carry the current, and
4. A supply of metal ions ready to deposit at the cathode.

A good knowledge of the characteristics of a plating bath is helpful to operate the bath efficiently and to understand the limitations of the bath. The abnormal condition may often be recognized by a good understanding of normal conditions.

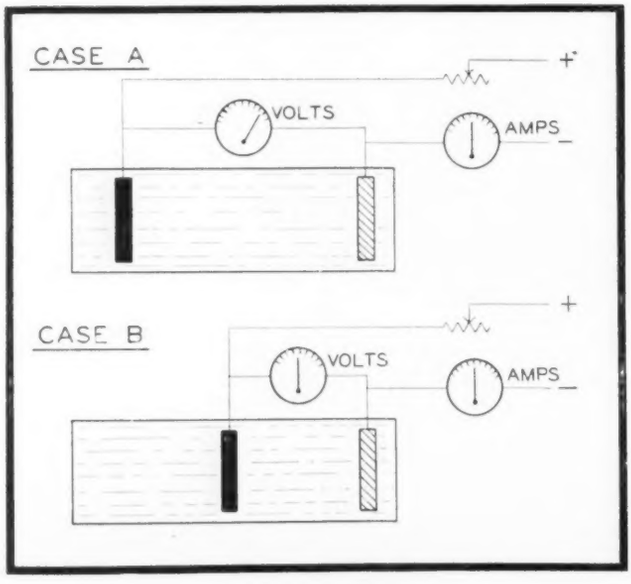

Fig. 1. Bath Voltage

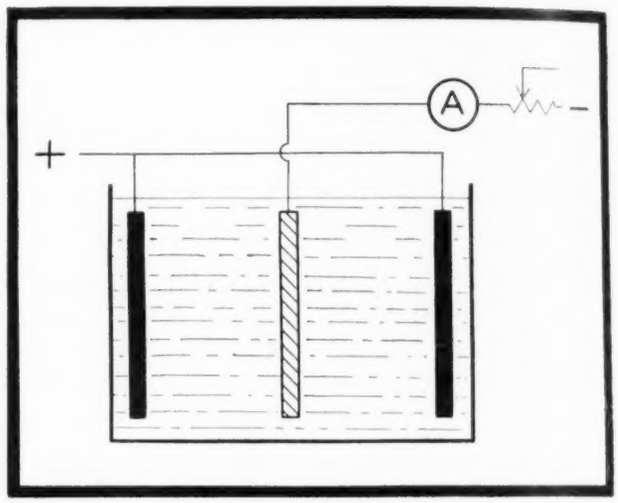

Fig. 2. Electrode Efficiency

An examination of plating bath characteristics shows that individual baths are well known for:

1. Low cathode efficiency as in an alkaline tin bath, a cyanide brass bath and a chromic acid bath.
2. Poor throwing power as in an acid zinc bath and a chromic acid bath.
3. Very high anode and cathode efficiencies as in a cyanide silver bath and an acid lead bath.
4. Necessity for anode polarization control in an alkaline tin bath.

This list of examples could be extended but it is sufficient evidence that each bath presents individual problems. A problem may be common to all baths but vary in degree. A problem common to all of these baths is that more metal will deposit on the point of the cathode that is nearest to the anode. The problem only varies in degree as the throwing power varies from bath to bath. The specification plater faces this problem through an understanding of plating and racking conditions and, through a knowledge of how to control throwing power by design of a good rack.

The best way to understand plating bath characteristics is to consider each characteristic. We shall proceed with such a consideration, starting with current density.

Current Density

Current density defines itself as "density of current"

or, the amount of current flowing per unit area of electrode surface. The current is usually measured as amperes and the area as square feet or square decimeters, so that we have amperes per square foot (amp./sq.ft.) or amperes per square decimeter (amp./sq.dm.). In plating chromium at high current density we may use amperes per square inch and, in measuring corrosion currents, we may measure milliamperes per square decimeter; but we still measure current and area and divide one by the other to obtain current density.

The trouble with current density is that it is very seldom uniform. It has an incurable habit of concentrating on corners and edges, and of dropping to very low values in recesses. Consequently we do not deal with actual current density but with average current density. The average current density is the total current divided by the total cathode area. The total cathode area includes (in addition to the total area of the piece being plated) the area of the exposed rack parts and the leads.

The plating rate is estimated on the assumption that the *average* current density is equivalent to *actual* current density. As an example: if the average current density is 20 amp./sq.ft. and the cathode efficiency is 50 per cent at an actual current density of 20 amp./sq.ft., then we assume that 50 per cent of the current plates metal at all points on the cathode. This is a fair assumption for an estimation if it is kept in mind that it is only an estimation. Such an estimation may be quite accurate for an alkaline tin bath and may be very inaccurate for a chromium bath. If we wish to plate chromium, we must strive to make the average current density as near as is practical to the actual current density. This is done through a knowledge of throwing power which is the same as saying that one understands current distribution and the variation in cathode efficiency with variation in current density. But this is another story and shall be taken up later.

When current density is not uniform and concentrates on corners and edges, high current density troubles (such as burning and treeing) take place. These objectionable troubles may be overcome in a number of ways.

1. By lowering the current density to a point where burning no longer occurs. (Providing build-up on the edges is not objectionable but only the burning is objectionable).

2. By proper positioning of the anodes.

3. By "robbing" the high current density area with a conductor.

4. By "shadowing" the high current density area with a non-conductor.

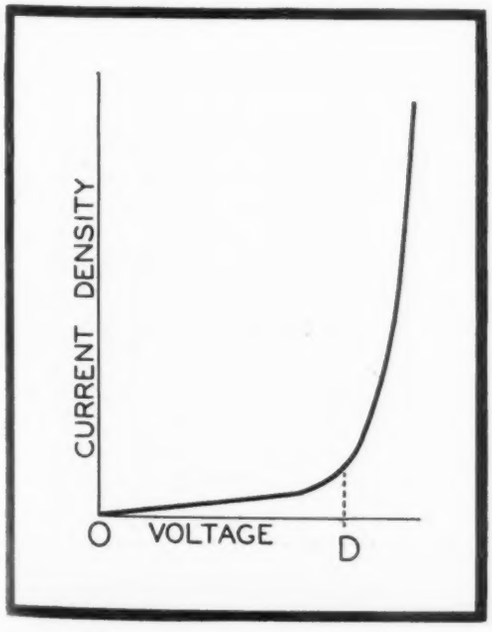

Fig. 3. Current Voltage Curve

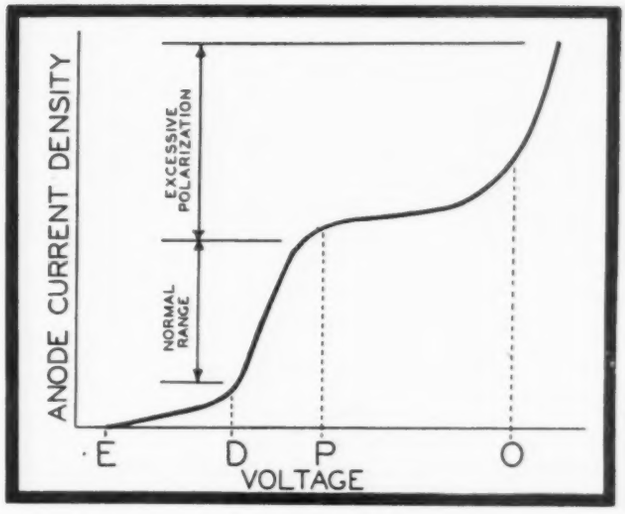

Fig. 4. Anode Polarization

Bath Voltage

The bath voltage is the electrical pressure required to produce the desired flow of electricity through the bath.

In plating, we are concerned with the thickness of the deposit, which depends on the current density and the time. Since current density depends upon amperage one may wonder why the question is often asked: At what voltage does one operate? Let us see why a barrel plater might ask this question.

A barrel plater may not be able to operate by current density, since it is almost impossible to estimate the area exposed to the current (because the parts are small and a great number of them are covered). Since he cannot determine the current density required for barrel plating, he must determine either the total current, or the voltage required, for a batch. This is determined by making a trial run. Voltage is commonly used as the means of current control.

The voltage required for barrel plating is somewhat higher than for tank plating. This is compensated for, somewhat, by increasing the metal content of the bath and by adjusting it to give higher conductivity.

The procedure followed in barrel plating is to measure, by weight or volume, an amount of work which, after the necessary pretreatment, is loaded into the barrel. The current is adjusted (by voltage control) to give the desired physical characteristics to the plate. Samples are with-

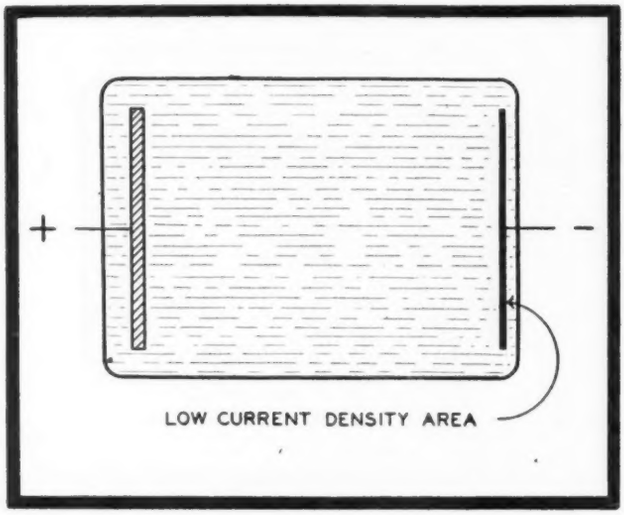

Fig. 5. Covering Power Cell

drawn at time intervals and plate thickness and appearance are checked. When the plate is within specified limits the load is discharged. By setting time-current standards in this manner, any further work of a like nature is carried out on a similar schedule.

Now; what voltage should be used in operating a still tank?

In most still plating operations the tank voltage does not assume too great an importance. The most notable exception to this is the alkaline tin bath. Here it is found that high voltage means excessive anode polarization, causing the anodes to become insoluble and resulting in metal depletion in the bath. Low voltage means depolarized anodes and results in the introduction of sodium stannite into the bath, which very quickly causes the cathode deposit to become dark and spongy. These conditions necessitate adjustment of the voltage to maintain proper anode polarization, which is indicated by a greenish-colored film covering the metal.

Abnormally high voltage in any bath operating at the proper current density would indicate:

1. Excessive anode polarization which might be caused by:
   a. Deficiency of the chemicals which promote anode corrosion, such as cyanide in a copper bath,
   b. Too small an anode area.
2. Low metal or conducting salt content.

Another question often asked is: Supposing one normally operates at 2 volts, what will happen if he operates at 3 volts? This question can be properly answered by saying: He cannot operate at 3 volts! Of course, he can operate at 3 volts but, when this question is asked, it is with the idea in mind that no changes are made other than the bath voltage. From this standpoint then, he cannot operate at 3 volts since the bath voltage can be increased only by:

1. Increasing the current density,
2. Increasing the resistance of the electrolyte by dilution or other means,
3. Decreasing the cathode area, or
4. Increasing the distance between the electrodes.

If the tank voltage were changed in such a way that the conditions at the cathode remained the same, the character of the deposit would be unchanged so that, in this sense, the tank voltage has no meaning.

This may be illustrated in the following manner:

Supposing two portions of the same electrolyte are poured into two separate Haring cells where the electrode distance is different in each case.

In both cases of Figure 1 the current distribution over the cathode is the same, because this is determined by the shape of the containing vessel and not by the electrode distance. In Case A the bath voltage is higher than in Case B merely because the electrode distance is greater; yet, in both cases, the conditions at the cathodes are identical. As a matter of fact, the conditions at both anodes are identical.

Electrode Efficiency

A properly operating silver cyanide bath maintains good metal balance because both the anode and the cathode operate at very close to 100 per cent efficiency. The metal is entering the bath at the same rate as it is removed and the metal balance is upset mainly by dragout. Unfortunately all baths do not operate like a silver bath, so that certain precautions must be taken to maintain the baths within operating limits.

Periodic checks on the electrode efficiencies are relatively easy to make by the following scheme:

The center electrode in Figure 2 is the cathode and the two outside electrodes are anodes. If a steady current is passed through the system for a known period of time, a definite weight of metal will be dissolved from the anodes and a definite weight will be deposited on the cathodes. To simulate production conditions, both anode and cathode current densities should equal, as near as possible, those used in the shop. Some errors will enter, due to high

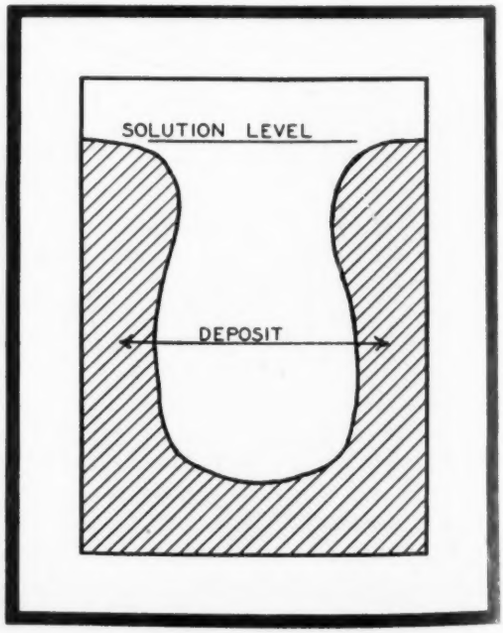

Fig. 6. Low Current Area Deposit

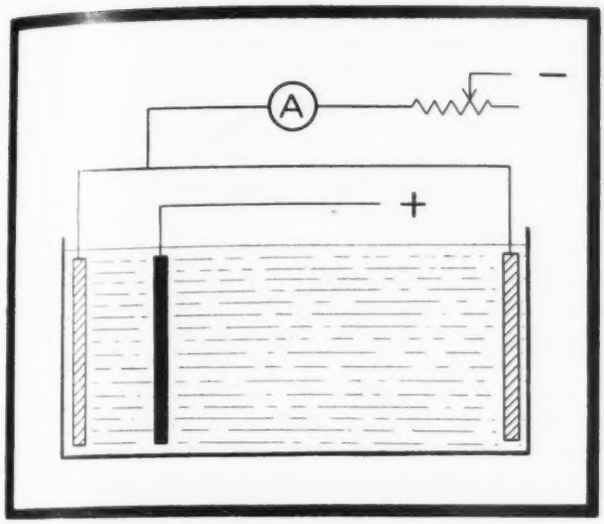

Fig. 7. Throwing Power Cell

current density area (on edges and corners), but still the results will be satisfactory for approximation purposes.

Weigh the electrode before and after plating and determine the change in weight. The efficiencies can be calculated by referring to a table of electrochemical equivalents (grams per ampere hour obtained at 100 per cent efficiency).

$$\frac{\text{grams per ampere hour obtained}}{\text{grams per ampere hour at 100\%}} \times 100 = \text{electrode efficiency}$$

Example:

Cadmium will deposit 2.10 grams per ampere hour. If during a test 1.20 grams of cadmium are dissolved in 30 minutes at 1.25 amperes, then:

$$\frac{1.20}{1.25 \times \frac{30}{60}} = 1.92 \text{ grams per ampere hour}$$

$$\frac{1.92 \times 100}{2.10} = 91.4\% \text{ anode efficiency}$$

The measurement of cathode efficiency affords a basis for calculating average thickness. For an actual thickness specification, the average thickness may be controlled by weighing a piece before and after plating. When such a practice is applied to the shop, the piece is known as a pilot piece. This procedure is more satisfactory than measuring cathode efficiency in the laboratory as the conditions are exactly as for all such parts which will be plated.

The average thickness may be calculated by referring to a table of grams deposited per mil for one square foot of area. (One mil = 0.001 inch).

Example:

One mil of silver on one square foot of area weighs 24.9 grams.

7.3 grams of silver were deposited on a piece 1.15 square feet in area.

$$\frac{7.3}{24.9 \times 1.15} = 0.25 \text{ mil}$$

If thin deposits are controlled by this method, the amount of metal removed in the pickling step will have to be determined and a correction made. This is an accurate method of determining average thickness, but it should only be used where the current distribution is controlled.

A piece may be used more than once to measure cathode efficiency and it is usually not necessary to pickle the piece if it is properly cleaned. In the instance of the deposition of thin deposits of indium or alkaline tin over steel, the cathode efficiency is low as initial deposition takes place and increases to a constant figure as the deposited layer becomes heavier. If thin deposits of indium were specified, it would then be necessary to use the pilot-piece method.

The metal balance of baths of unequal anode and cathode efficiencies (such as cyanide zinc, cadmium and copper) is maintained through the use of a proportion of insoluble anodes along with the regular anodes. It is not unusual for baths of this type to operate for years with no addition of metal being made as salts.

An excellent example of the exact opposite type of maintenance is the chromic acid bath wherein insoluble anodes are used and the metal balance is maintained by salt additions.

The importance of a knowledge of the efficiency at both electrodes may be illustrated by the Rochelle copper bath. If the bath is out-of-balance, the following electrode corrections may be made:

Anode efficiency may be increased by:

1. Increase in temperature.
2. Solution agitation.
3. High free cyanide.
4. Low anode current density.
5. Removal of excessive carbonate.

Cathode efficiency may be increased by:

1. Increase in temperature.
2. Increase in metal content.
3. Decrease in free cyanide (by increasing metal content).
4. Decrease in cathode current density.

The chemical composition should only be changed within

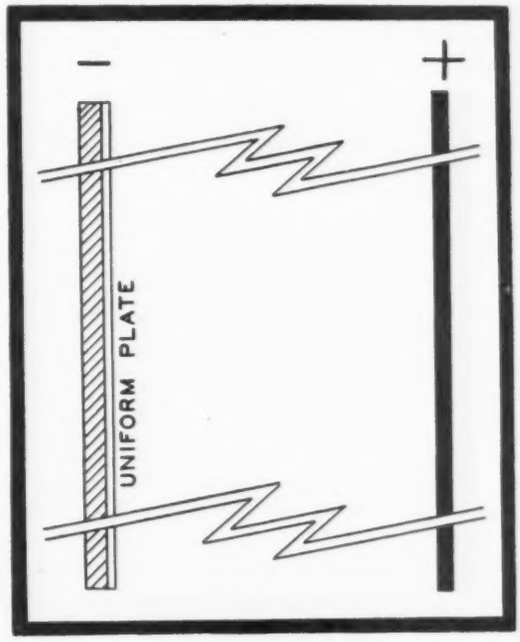

Fig. 8. Infinite Planes

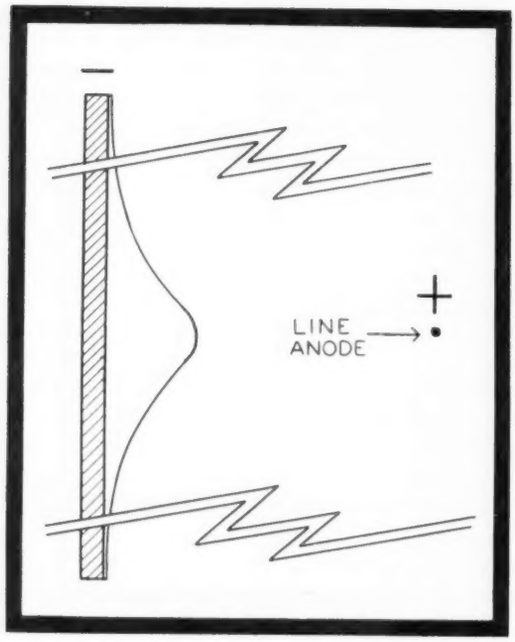

Fig. 9. Plating from a Line to a Plane

the prescribed chemical limits; the cathode current density may be changed within reasonable limits; but the anode current density may also be changed (by changing the anode area) and, by the use of insoluable anodes, the bath may be restored to balance. A ratio of anode to cathode area of 2 to 1 is recommended.[1]

Polarization

Polarization makes itself known in many ways, such as:

1. Increase in bath voltage.
2. Decrease in bath current.
3. Excessive gassing at the electrodes.
4. Formation of films or chemical products at the electrodes.

We often think of polarization as a plating bath trouble. It is occasionally troublesome when excessive, but it is something that is always present. If a current flows through a bath or plating cell, it is accompanied by polarization, which may be looked upon as a counter-force, built up to resist the flow of current. Polarization may be divided into:

1. Normal polarization, and
2. Excessive polarization.

When we say, "The anodes are polarized," we usually refer to excessive polarization (such as is caused by low free cyanide in a cyanide copper bath). Of course, the anodes are actually polarized at all times that the current flows:

Excessive polarization is not merely high polarization, for the polarization may be high and yet be normal, as in the case of the alkaline tin bath already mentioned. In the chromic acid bath, using lead anodes, the lead peroxide that forms on the anodes is a type of polarization. The polarization is helpful in this case since the lead peroxide serves to oxidize trivalent chromium to chromic acid.[2]

Glasstone defines polarization as: "Any departure of an electrode from equilibrium conditions, no matter what the cause, . . ." [3]

The loose use of terms related to polarization prompted a paper by Blum and Vinal.[4] They defined the terms polarization, overvoltage and decomposition potential, and showed how these terms are related. It is only through the use of physical chemical equations that these definitions can be exact. We do not have to be concerned with these exact definitions since we are interested in the qualitative results of polarization (what it does in a plating bath and how to correct or control it).

Although we need not be concerned with the mathematics of polarization, let us consider the equilibrium potential.

When pH is measured electrometrically, the equilibrium potential of the system is what is measured. On a commercial instrument it is read directly in terms of pH, although the measurement is in volts. The equilibrium is a static potential, meaning that there must be no flow of current across the cell during the measurement. Since there is no flow of current, there is no polarization, although there is a definite static voltage. This voltage merely indicates a storage of chemical energy and no flow of current is needed to detect it (as in the case of current flowing in a wire). This potential (voltage) is the one that would exist at zero current density.

If an electrolytic cell contains an anode and a cathode of the same metal in a solution containing metal ions (such as two copper electrodes in a copper sulfate solution), the potential will be zero. The potential at each electrode is equal and opposite. If one of the electrodes is removed and replaced by a calomel half-cell, a definite potential will be obtained. The potential of the copper electrode can be calculated by subtracting the value of the calomel cell from the total voltage. This potential is known as the "single electrode potential."

If two platinum electrodes are immersed in a solution of sulfuric acid, and the voltage measured at increasing current density, a curve as represented in Figure 3 will be obtained.

As the current is increased from the point 0 to the point D on the voltage—amperage curve—a small current flows.[5] This is known as the diffusion current. No reaction product appears at the cathode in this range. It is, therefore, below the normal plating range.

At point D electrolysis begins and the voltage at this point is known as the decomposition potential. Beyond the

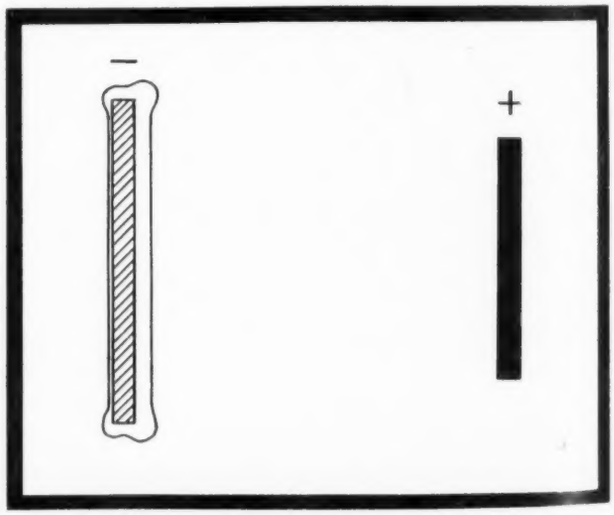

Fig. 10. Plating with One Anode

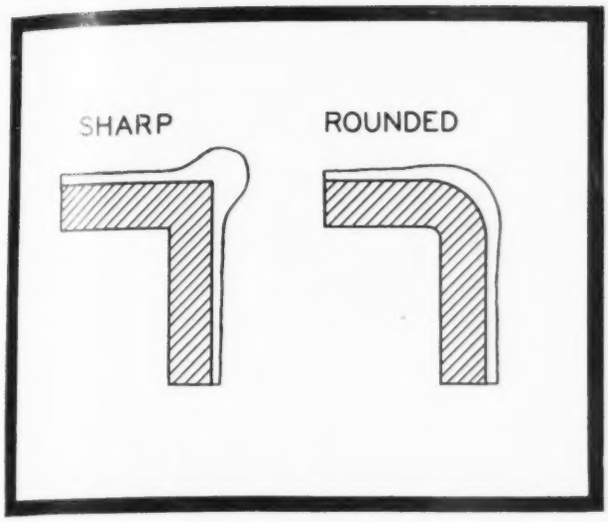

Fig. 11. Outside Corners

point D a large increase in current is accompanied by a small increase in voltage. This is the normal plating range.

Blum and Vinal offer the following definitions:

"The 'decomposition potential' is the minimum potential required for continuous electrolysis."

"The term 'overvoltage' preferably refers to the minimum polarization required for any electrode process to occur at an appreciable rate under given conditions."

Using bright platinum electrodes, 10 cm. apart, in 2 normal sulfuric acid, these authors report a decomposition potential of 1.70 volts. This potential is the sum of:

1. The minimum potential for the decomposition of water (1.23 volts) plus,
2. The total polarization at the anode and the cathode plus,
3. The IR drop offered by the resistance of the solution.

The minimum potential for the decomposition of water is calculated from thermodynamic data and is not the same as the potential that would be obtained at zero current density (the static potential at zero current density would be zero volts for this system). This potential is called the "equilibrium reaction potential" and is equal to the difference between the potentials of a hydrogen electrode and an oxygen electrode in 2 normal sulfuric acid.

Bath voltage does not become excessive when the products of the reaction escape as a gas or as a readily soluble salt. When insoluble solids build up on the electrode, it is possible to build up higher voltages. Let us consider a few practical aspects of this type of polarization.

In the process of anodizing, an aluminum electrode is made the anode in a chromic, phosphoric, sulfuric or oxalic acid solution. To maintain the original anode current density, a greater voltage is required with the passage of time. Presently the current density drops, and finally a high voltage is obtained and very little current is passed. This is due to the formation of aluminum oxide which tends to insulate the anode.

If the current density is increased on a silver anode in a cyanide bath, the following will be observed: As the current increases, the anode will turn from white to grey. It will next turn brown and finally black. After the anode turns black, oxygen gas will be liberated. The anode is now insoluble. If the voltage is adjusted so that the color of the anode fluctuates between grey and brown, the high points of the metal will be removed faster than the low points. The anode will become smooth and bright. This process is known as electrolytic polishing.

If the cyanide content is low in a silver or a copper cyanide bath, the anode will polarize and the products formed at the anode will hinder the flow of current. Severe polarization will cause the anode to gas, resulting in insufficient metal supply to the bath. This condition is recognized by high bath voltage and is remedied by addition of cyanide to the bath.

If a copper anode and a steel anode are suspended in a copper bath at the same time, all the current will leave from the copper anode at low current density. As the current density is increased, polarization increases on the copper anode. When the voltage reaches the value for oxygen overvoltage on steel, the steel anode will begin to gas. Since current now leaves from the steel anode; excessive polarization is prevented on the copper anode and the steel may be regarded as a depolarizer (which is any substance that tends to reduce the extent of polarization). If the current density is further increased, a point will be reached at which the steel anode begins to decompose to form ferrocyanide.

Figure 4 shows, diagrammatically, the steps during polarization of a copper anode in a cyanide bath. The curve is similar to Figure 3 in the lower portion.

Point E is the equilibrium potential (at zero current density).

Point D is the decomposition potential (or the point at which copper begins to dissolve at 100 per cent efficiency).

Point P is the point of excessive polarization (or the point at which films begin to form on the copper anode).

Point O is the point above which oxygen is liberated exclusively (or the point above which the anode efficiency is zero).

Covering Power

A problem presented in plating articles containing deep recesses is that of obtaining complete coverage of the piece. Acid baths are generally poor in this respect, while the alkaline baths are usually good. The ability of a bath to plate into low current density areas is referred to as covering power.

A simple qualitative test for this property may be con-

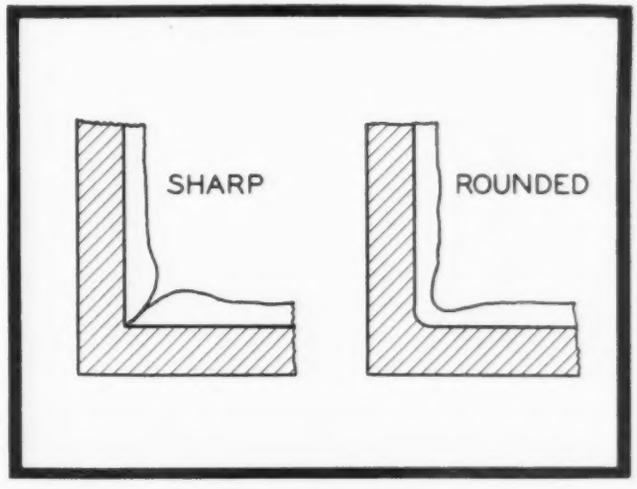

Fig. 12. Inside Corners

ducted by plating on a cathode arranged so that the back is shadowed and difficult for the current to reach.

If a test is set up as in Figure 5, it will be found that part of the back of the plate will be covered. This low current density area may appear as in Figure 6. By increasing the total current, the back may cover completely. In a practical sense this cannot be done since excessive metal will be obtained in high current density areas. Burning may even result from such a practice.

Covering power may be tested by using an arbitrary set-up, as shown in Figure 5, or by using a standard plating test. In a standard plating test, such as the Hull cell, covering power may be measured as the minimum current density at which plating will take place. These plating tests are of value in that they afford a rapid means of testing and adjusting the covering power of a bath to a maximum coverage.

It may be desirable to use an acid bath to plate a specific complicated shape. Yet it may not be possible to do so without using an excessive amount of metal. Small-scale tests on the piece will indicate whether addition agents, special racking or arrangement of anodes will aid in solving the problem. Even a change in the cleaning procedure or addition of a strike step may help. For instance, an acid lead bath will cover better over steel if a copper strike is used.

Throwing Power

Covering power is related to throwing power. If either is high, plating will take place in low current density areas. Throwing power is concerned with a quantity of metal rather than a minimum current density. Thus, it is measured as a definite value. It is necessary to know the quantity of metal in a recess to know if a specification for minimum thickness can be met.

Throwing power may be measured quantitatively by the method of Haring and Blum.[6] This method makes use of a long, narrow cell containing one anode and two cathodes. The cathodes are placed at either end of the cell and unevenly spaced in relation to the anode. From the weight of metal deposited on each cathode, a numerical value for throwing power is obtained.

By this quantitative measurement the effect of additions of salts or addition agents can be measured. There is some doubt of the absolute value of the measurement obtained[7] but the method can certainly be used to compare one bath against another.

Metal Distribution

An ideal distribution of metal on the surface of an article is almost impossible to attain. This amount would be such that the coating would fail from all causes and in all areas at the same time. This one-horse-shay-distribution would mean sufficient metal to protect the piece against corrosion in all areas, plus excess metal for those areas exposed to wear.

In actual practice sufficient metal is plated so that significant surfaces are adequately covered and recesses receive a proper amount of plate. To do this, excess metal will be deposited in some areas. On intricate shapes it becomes difficult to plate in low current density areas without overplating in others.

Some measurements of metal distribution have been made but there is an insufficient amount of experimental data available. A good estimation of what to expect on a new shape can only be determined by actual test.

In a series of articles, Charles Kasper of the National Bureau of Standards, worked out equations for current distribution. From a knowledge of the current distribution, the cathode efficiency, the cathode polarization and Kasper's equations, predictions for certain shapes may be made. Such problems are too complex for anything short of a research study. However, in his first article[8] Kasper points out some general principles that give an indication of what to expect.

For the purpose of illustration it is best to restrict ourselves to 100 per cent cathode efficiency and to specify zero polarization. It will then be shown how the cathode efficiency and polarization cause the plate distribution to differ from the theoretical current distribution.

If a current is applied to two parallel planes of infinite size, the current will be distributed evenly over each. If plating takes place at the cathode, a uniform plate will be obtained (Figure 8). If plating takes place from a line anode to an infinite plane, the plate will vary in thickness, inversely as the square of the distance from the line anode as shown in Figure 9. If plating takes place from a point to a plane, the plate distribution will appear similar to

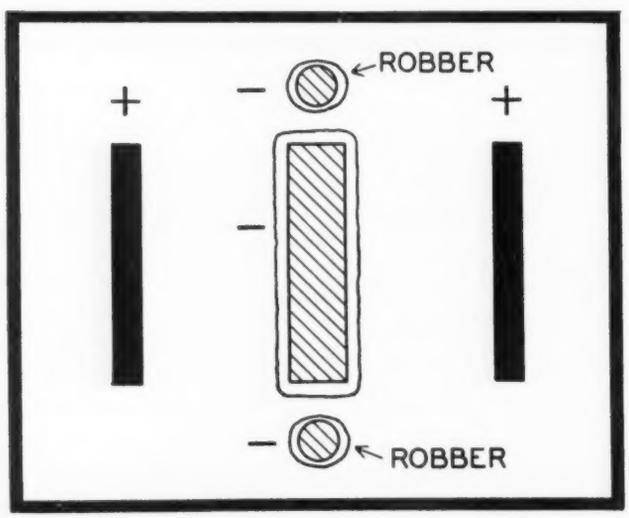

Fig. 13. Robbing

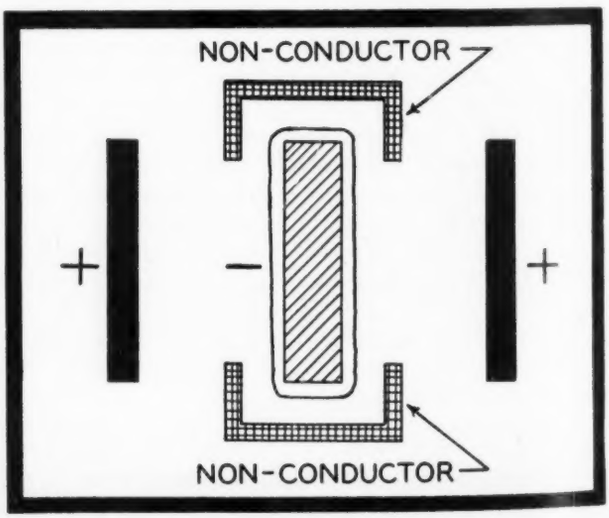

Fig. 14. Shadowing

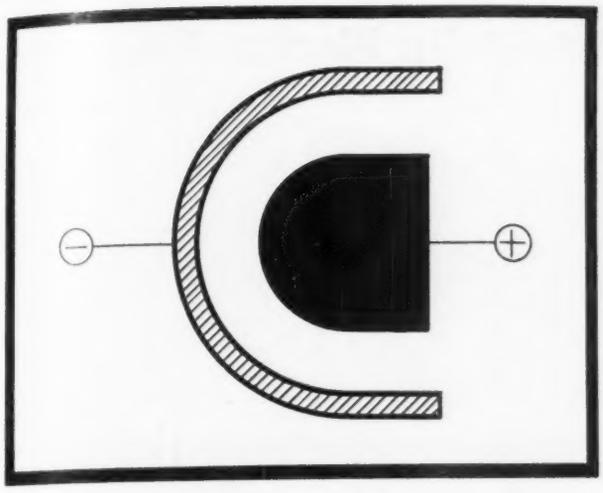

Fig. 15. Shaped Anode

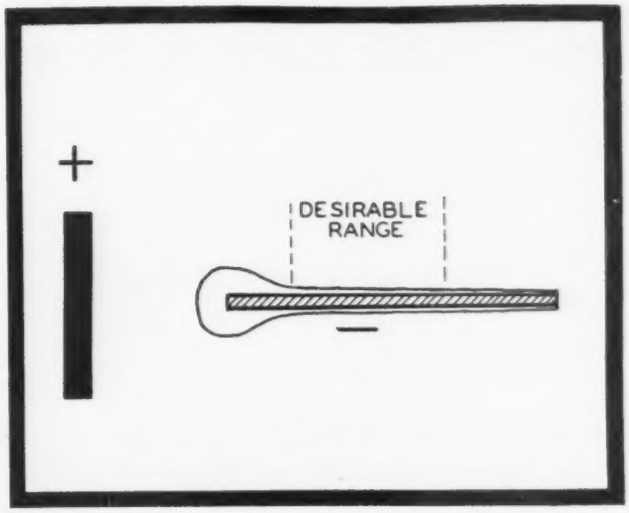

Fig. 16. Plating Range

Figure 9. It will be more exaggerated since the plate will vary inversely as the cube of the distance from the point to the plane.

If plating takes place from an anode to a cathode of real dimensions, the plate will tend to be uniform in the large, flat areas. It will be much heavier on the edges and heaviest at the corners. This condition is the result of flat surfaces, edges and corners tending to receive the current as, the first, second and third powers. The plane receives the current principally from one direction, the edge from two, and the corners from three.

Figure 10 shows the approximate distribution for a real case. The plate is heavier on the front than on the back. The thickness increases gradually as it approaches the edges and becomes much heavier on the edges. On corners it will become much heavier and may burn or tree in these high current density areas. If an anode is placed on each side of the cathode, then the thickness on opposite sides will be similar.

In actual plating baths, the variation in thickness is most severe for those baths that are poor in throwing power, such as the chromic acid bath. The acid zinc bath is also especially poor in this respect.

If cathode polarization increases markedly with increase in current density, then throwing power and metal distribution become more favorable. This is true because polarization is a reverse voltage that tends to reduce the normal flow of current.

In alkaline and cyanide baths, throwing power is good and metal distribution favorable. Deposits from a cyanide silver bath will approximately change in thickness inversely as the distance from a line anode, rather than inversely as the square of the distance. A stannate bath will cover even more favorably than a silver bath, due to the change in cathode efficiency. The cathode efficiency drops very rapidly as the current density is increased. The cathode efficiency is, therefore, lowest in the high current density areas. The plating rate is about the same at high current densities as at moderate current densities so that throwing power, covering power and plate distribution favor a uniform deposit.

If a bath is characterized by poor metal distribution, there are various remedies that may be tried.

Sharp corners may be eliminated in design (Figures 11 and 12). High current density areas may be robbed of current by use of a secondary cathode (Figure 13). High current density areas may be shadowed by use of a nonconductor (Figure 14). Low current density areas may be reached by shaping the anode to conform to the shape of the cathode (Figure 15). The current distribution characteristics can be changed by modification of the bath or by the use of addition agents but, often the problem can only be solved by robbing, shadowing or anode arrangement.

Plating Range

Most plating baths produce a satisfactory plate over a limited range of current density. Above this range the plate may be crystalline, rough or treed. Blow this range it may be spotty or covering may be poor.

Plating range may be tested by an arrangement that gives a continuous change of current density over the cathode. If an anode and cathode are arranged as in Figure 16, the plate distribution may be as shown. The current density changes continuously along the length of the cathode. Over a portion of this range the plate will be satisfactory, depending on the bath.

Such an arrangement may be used as a test for plating range providing the arrangement is reproducible. Enough data must be taken to calibrate the arrangement. Several standard arrangements are acceptable for this type of tesct. They are the bent cathode test [9] and the Hull cell test.[10]

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1. A. K. Graham. "Plating and Finishing Guidebook," p. 15 (1943).
2. G. Dubpernell. Trans. Electrochem. Soc., **80**, 601 (1941).
3. S. Glasstone. "The Fundamentals of Electrochemistry and Electrodeposition," p. 59 (1944).
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7. W. Blum, A. O. Beckman and W. R. Meyer. Trans. Electrochem. Soc., **80**, 256 (1941).
8. C. Kasper. Trans. Electrochem. Soc., **77**, 353 (1940).
9. Pinner and Baker. Trans. Electrochem. Soc., **55**, 315 (1929).
10. F. MacIntyre and R. O. Hull. Proc. Amer. Electropl. Soc. (1943).

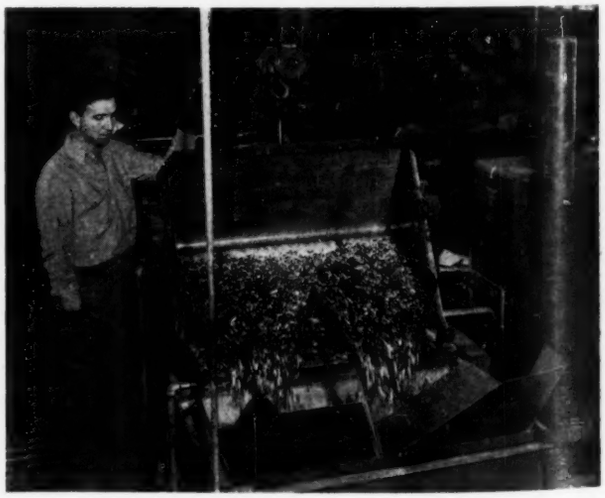
Gas-Fired Immersion Heaters Speed Up Plating Production

WHEN the Chemical Plating Company moved into their new building in Stratford, Connecticut, during June, 1946, they installed considerable new automatic electroplating machinery and specially designed cleaning and washing tanks in which the solutions are heated by means of gas-fired immersion burners. These are all atmospheric immersion burners having a rated input of 400,000 B.t.u. each.

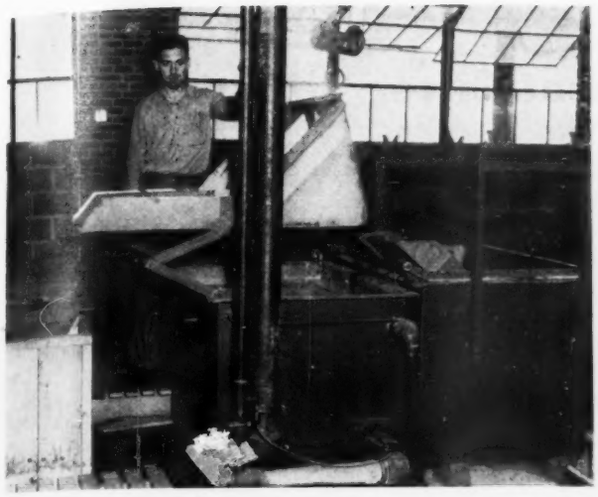
This company was only established two years ago as a job plating business which, in this short time, outgrew their former shop and necessitated a new plant to accommodate the demands made upon them for plating small parts. An endless variety of items by the thousands passes through the plant, which is equipped to do plating in brass, copper, zinc, cadmium, nickel, chromium and tin.

In their former shop they had a four-barrel plating unit, with which they were able to turn out about 1,700 pounds per day. Here in the new plant with only a three-barrel automatic unit and the gas-fired immersion heaters on the cleaning and washing tanks, they have been able to step-up

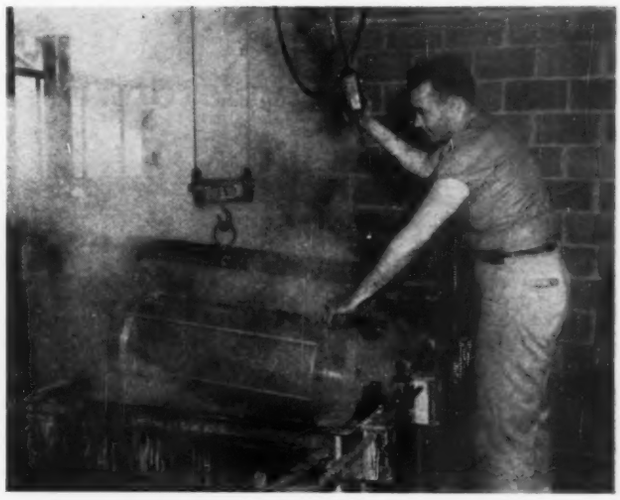
A general view of the "still" plating section.



Plated parts being dumped into final hot rinse.



From the final hot rinse the plated parts are transferred to centrifugal driers.



A plastic barrel, with a charge of small parts, being lowered into hot alkaline bath, heated by gas-fired immersion burner.

production to 2,500 pounds per day—a considerable increase in volume and a consequent reduction in unit cost.

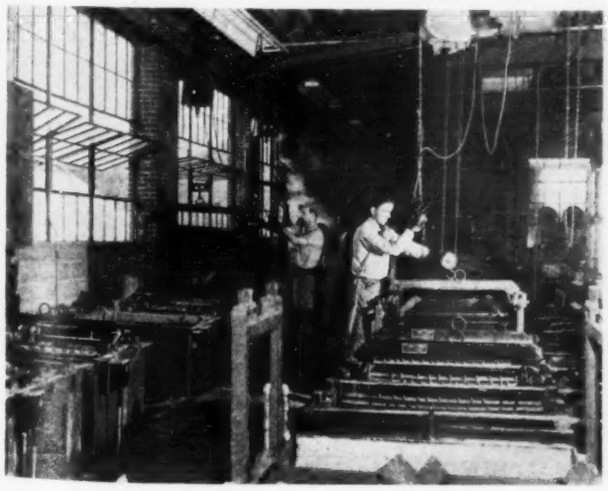
The plating operations take place in a large airy room which is open on two sides thus providing ample ventilation and good light. Most of the small parts plating is done in the automatic barrels. The first step in the plating process is to thoroughly clean the parts in an alkaline solution to remove all traces of grease and foreign matter which may affect the plating. This first alkaline bath is kept at boiling temperature by a gas-fired immersion heater. The next tank is a hot-water rinse, then on to a secondary wash and rinse, in which all tanks are fitted with immersion burners which keep the solutions boiling. After thorough cleaning, the barrels, loaded with parts to be plated, are picked up on an overhead conveyor and placed in the particular tank for plating as required on that part.

When the barrels have been in their respective plating baths for the prescribed time to acquire the proper thickness of plate, they are conveyed to successive hot rinsing baths, also heated by means of gas-fired immersion burners to the boiling point. From the final wash they are placed in centrifugal dryers, and in certain instances, further dried in sawdust. When a high polish is desired as in the case of nickel and chromium deposits, the parts are polished in tumblers.

Parts that are too large, or of such a nature that it is impractical to use the automatic barrel processing, are done in "still" tanks where the parts are either placed in baskets or hung on individual hooks. In the "still" plating section the same cleaning and washing takes place as in the automatic barrel processing and the hot tanks in this section are also heated by gas-fired immersion burners to boiling temperature.

Installation of unit space heaters is going forward to provide heat for the plant during the winter months. Products of combustion from the immersion heaters are piped to outdoors, and the ventilating system provides many air changes and a clear atmosphere for workmen.

The plant of the Chemical Plating Company, while small, is a model of efficiency and cleanliness due in a large measure to the gas-fired equipment for processing and space heating.



The automatic barrel plating section.

Drying sawdust is shaken from these nickel plated belt buckles.

An Analysis of the Present Silver Situation

By RICHARD A. MOZER

New York, N. Y.

Review of silver prices since 1920 and their causes is given. Analysis is made of the present demand and its distribution in Industry. The present silver market is investigated and the future price line noted.

A DISCUSSION of the present silver situation necessarily entails a review of the factors, both economic and political, contributing to it. Although silver is abundant for the arts and industries, there has been considerable significance attached to it over the years by individuals, industries and governments.

Immediately following World War I, the Government restrictions on silver were removed and the price jumped to $1.37½ per ounce. By the end of 1920, however, the price had stabilized itself at 59 cents in America, due to the huge influx at the higher price. In 1934, by passage of the Silver Purchase Act, Congress fixed as an objective one-quarter of the Treasury's monetary reserve to be maintained as silver and in 1939 the Green Act was passed establishing the price at 71.11 cents per ounce. During this period the price was regulated by Presidential proclamation and approximately 2 billion 700 million ounces of silver was purchased by Uncle Sam, from both domestic and foreign sources. During most of the war and up to the end of 1945, the Treasury made silver available to industry from its vast stocks. However, the law authorizing this to be done expired on December 31, 1945, and Congress did nothing about it at that time. Eastern Congressmen, on behalf of industrial users of silver, attempted to maintain the price at 71.11 cents as established in the Green Act; such legislation would have released the 225 million ounces held by the Treasury. The western bloc of Senators, however, naturally opposed the price; although they were willing to release the excess Treasury stock, they demanded that legislation be passed lifting the price of silver to its monetary value of $1.29 per ounce. The recent bill signed by President Truman fixes the price at 90.5 cents an ounce and represents a compromise between the silver-producing and the silver-using States. The entire cost-history of silver from 1900 to 1945 is shown, with notations, in Figure 1.

THE SILVER MARKET
THE NEW YORK OFFICIAL QUOTATION
Issued daily since 1892 by
HANDY & HARMAN · 82 FULTON ST., NEW YORK
Precious Metals Since 1867

Fig. 1

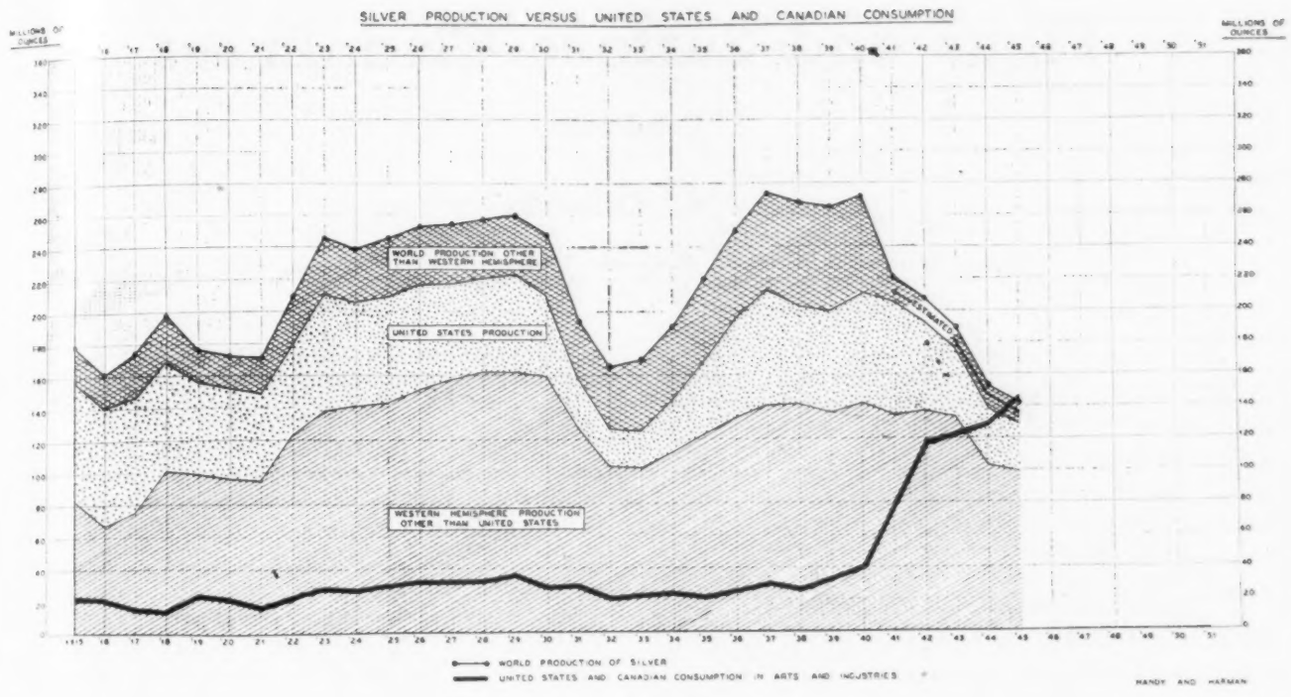

SILVER PRODUCTION VERSUS UNITED STATES AND CANADIAN CONSUMPTION
MILLIONS OF OUNCES
WORLD PRODUCTION OTHER THAN WESTERN HEMISPHERE
UNITED STATES PRODUCTION
WESTERN HEMISPHERE PRODUCTION OTHER THAN UNITED STATES
WORLD PRODUCTION OF SILVER
UNITED STATES AND CANADIAN CONSUMPTION IN ARTS AND INDUSTRIES
HANDY AND HARMAN

Fig. 2

There is a tremendous demand for silverware products in this country, particularly for the holiday-buying season of 1945. As shown in Figure 2, this is the first period in which the demand exceeds the supply. Commercial availability of silver since March, 1946, has been only about 10% of requirements. As a result, manufacturers of silverware and silver flatware, the latter being 65% copper, 18% nickel and 17% zinc with a plated coat of pure silver, must speed up production lines and then fill retailers' depleted stocks. This will take several months, although the pure silver itself is available in quantity. "Silverware" is generally composed of 92½% pure silver and the balance copper, for strength.

Silverware consumers comprise about one-half the entire demand for pure silver this year. Based on estimates made in 1945, the requirement for this year was fixed at 125 million ounces; however, because of the unavailability of silver during the first six months of the year, the estimate has been revised to 90 million ounces. This means an enormous added impetus to the processing and metal finishing industries. Huge quantities of equipment for the manufacture and finish of silverware and flatware are to be utilized in the immediate satisfaction of this pent-up demand.

Approximately 10% of the total estimated requirements go to the jewelry manufacturers and finishers. Here too, a portion of the silver is used as a major element in alloying; the balance as a plated coat over less expensive metals. In fact the demand, dollar for dollar, is said to be approximately as great for plated low-cost jewelry as it is for more expensive items.

Of the remaining 40%, an aggregate of 36 million ounces, the photographic field will require 14 million, electrical equipment firms 10 million, silver brazing and soldering 7 million, and miscellaneous usage 4.5 million. The photographic field uses silver to coat film; in the electrical industry, silver and its oxide are conductors, hence contacts, sliding switches are made of silver, while radar and television apparatus are silver plated, to mention a few applications. The pure metal is used in alloys for fillings; pharmaceutical houses use quantities of the metal; and for brazing or soldering, silver compares favorably with the more unwieldly and costly welding operations. Miscellaneous users consist of aircraft bearing manufacturers, chemical houses, etc.

With the new price of 90.5 cents per ounce, a 27% increase, stimulus is given to both foreign and domestic silver producers. There is at present plenty of silver for all and it consists mostly of fresh metal from home and abroad. The vast quantity held by the Treasury serves as a "bank" in the event of an emergency, although it is prepared to sell all its unobligated stocks to whomever desires to buy. If a buyer desires to purchase silver, he does not necessarily have to secure it from the Treasury at 90.5 cents per ounce; it is quite possible he may get it for considerably less on the open market. In fact, with the ceiling raised from 71.11 cents per ounce, foreign held silver is appearing at present for lower cost. This together with the fact that the domestic production picture has cleared after a period of strikes and unavailability of refining equipment and supplies, should mean that the price of silver will be competitively held well below its statutory level.

Films and Surface Cleanliness

Conclusion

By JAY C. HARRIS

Central Research Department, Monsanto Chemical Company, Dayton, Ohio

Cleaning

Alkali and Electro-Cleaning. The following materials are widely used in water solution as metal cleaners:

Alkali carbonates
Caustic soda
Alkali silicates
Alkali phosphates
Soap
Synthetic wetting agents and detergents.

Mechanical films may be formed in soak or spray tank cleaning by the alkaline materials, but the silicates and phosphates may additionally form protective insoluble films.

Soap and synthetic wetting agents and detergents possess colloidal properties and as such, can form adsorbed films of organic materials at the metal surface interfaces.

Films of soap have been measured, and palmitic acid for example, has a cross-section of 20.5 square Å and a length perpendicular to the surface of 24.2 Å. All the fatty acids regardless of carbon chain length exhibited the same area[9]. It is said that lateral adhesion between the long chains probably assists in aligning the molecules by packing them side by side. In an uncompressed polar film on water the surface covered is greater than when the film is compressed, and it is possible that this same mechanism occurs, graphically shown in Figure 4. This may be ascribed to the fact that in a compressed film the area covered is proportional to the diameter of the chain, while when uncompressed, the area is proportional to the chain length.

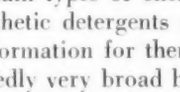
In connection with soap and inhibitors the data given in Table IV is of interest since it shows the average area in square Å of certain types of chemical compounds. Unfortunately the synthetic detergents and wetting agents are so new that like information for them has not been developed. but as an admittedly very broad basic assumption, they may be considered as equivalent to fatty acids, and thus adsorbed to essentially the same extent. This probably will not hold true for all the types and kinds of synthetic surface active agents, but is a reasonable working assumption.

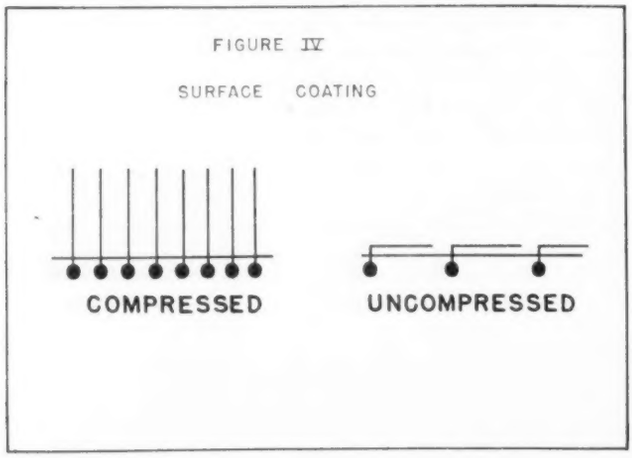
On the basis of adsorption, soap may be carried over into acid plating baths and result in interior processing. Furthermore, water-break as an indication of freedom from undesirable film may be entirely unreliable due to adsorbed layers of surface active agent providing a predominantly water attractive film.

Most of the surface active agents used in pickling baths appear to act as inhibitors, and if so, they are preferentially adsorbed. In alkaline electrocleaning baths with the work cathodic, the surface active agents, if of the proper type might be preferentially plated out, eventually reducing the evolution of hydrogen. Usually however the work is in the bath a relatively short time and equilibrium is not established, but a certain amount of adsorption must result.

TABLE IV

RELATIVE AREA OF ORGANIC CHEMICALS

Chemicals	*Polar Group*	*Area @ 0 Compression Å²/mol*	*Minimum Number of C in Chain to Render Film Condensed @ 15°*
Acids on Water	—COOH	20.5	13
Amides	—$CONH_2$	20.5	13
Methyl Ketones	—$COCH_3$	20.5	14
Ureas	—NH-CO-NH_2	26.0	13
Esters of Saturated Acids	—COOR	22.0	Various
Alcohols	—CH OH	21.6	11
Phenols		24.0	12
Cholesterol	—	40.8	—
Hydrolecithin	—	52	—



With the work anodic, anionic detergent ions must assuredly be deposited on the work.

In soak-bath cleaning a considerable degree of ionization occurs and local electrolyte or corrosion cells must be established. Under these circumstances films of metallic and alkaline salts will be formed which will be difficult to remove except by vigorous rinsing. However, as one investigator has pointed out, a piece can be no cleaner than the last rinse bath[1]. Consequently any contamination of the rinse water either by drag-out or as a result of water hardness may result in substandard work. In either case a film of varying characteristics is formed which may either cause corrosion during storage prior to continuation of manufacture, or formation of a film preventing subsequent uniform processing. These films may be almost invisible yet cause rejects.

TABLE V

CHARACTERISTICS OF SURFACE-CONVERSION COATINGS (JERNSTEDT)

Base	*Finish*	*Coating and Thickness*	*Solution Type*	*Appearance*
Iron and Steel	Phosphating	Ferro-Zinc phosphate complex. 0.00005 to 0.0001 in.—Bonderized 0.0001 to 0.0003 in.—Parkerized	Phosphoric acid, Zinc Nitrate, Ferrous Phosphate, sodium nitrate	Dark matte gray crystals visible at 20X.
	Bluing and Blackening	Ferro-ferric oxide, 0.00004-0.00008 in.	Sodium hydroxide Sodium chlorate	Thin, blue-black, smooth finish
Copper and Brass	Oxide and Sulfide	Cupric Oxide or sulfide 0.00005-0.0001 in.	Sodium carbonate, Ammonium hydroxide, Copper carbonate, Sodium sulfate	Blue-black or Brown-black
	Oxalate	Copper oxalate compound, 0.00005-0.0001 in.	Acid Oxalate solution	Gray matte appearance
Aluminum	Anodic	Amorphous Al_2O_3 generally 0.0001 to 0.001 in.	Chromic, boric, sulfuric or oxalic acids	White or gray unless dyed or colored with chromates
	Chemical	Aluminum phosphate, about 0.0001-0.0002 in.	Phosphoric acid and accelerators	Gray matte
	Chemical	Al_2O_3 and hexavalent compound (Cr_2O_3), 0.00005-0.0001 in.	Sodium carbonate and dichromate	Yellowish-brown matte
Magnesium	Anodic and Chemical	Magnesium oxide and hexavalent chromium salt, 0.00005-0.0001 in.	Dichromate, phosphate, sulfate, fluoride, sodium hydroxide and phenol	Usually yellow or brown. Can be iridescent or gray
Zinc	Phosphating and Chromating	Zinc-ferro phosphate (Also Ni-Fe). Chromate tri-and hexavalent compounds. 0.00005-.0001 in.	Phosphating same as steel plus nickel ions. Chromate-chromic acid plus sulfuric acid	Phosphate-gray matte, crystallin chromates—iridescent yellow

Vapor or Emulsion Degreasing. Each type of cleaning process has applications which make it predominantly useful for certain applications. Vapor, solvent immersion, or emulsion degreasing baths are of value where adsorbed films of fatty acid, organic detergent, or very thin oil films will have negligible effect upon latter processing. As a matter of fact, the adsorbed films may act as preservatives, permitting inspection of the surfaces without danger of corrosion. Such adsorbed films often need not be removed if the subsequent treatment involves the use of materials containing organic solvent, since it is a good general rule that a surface will recognize the type of liquid with which it was last wet. In other words, a surface which was last wetted by non-polar solvent such as a chlorinated hydrocarbon is most readily re-wetted by a similar type liquid: Conversely a surface last wetted by water or other polar solvent will exhibit a certain degree of resistance to non-polar liquids. When this general adsorption phenomenon is recognized, the reasons for certain processing difficulties may become evident.

Degreasing solvents, especially the chlorinated ones, may contain materials such as amines which inhibit decomposition and the formation of free hydrochloric acid. The inhibitors are chosen to conform to the characteristics of the solvent, and as such may volatilize with, and be condensed with solvent on metal or may form compounds which, in the presence of water film, may ionize as do the inhibitors and be adsorbed similarly. This phenomenon would be most likely to occur in full immersion under improper conditions of operation control.

Emulsion degreasers contain surface-active emulsifying agents which previously have been shown to be adsorbed at metal surfaces. In this case the metal surface should be predominantly water-attractive, since this was the last liquid medium with which contact was made, but it is possible that with sufficient emulsified solvent, a film of oil could be deposited on the surface, making it hydrophobic.

In all cases the condition of the metal surface will have marked effect upon retention of bath constituents, and the possibilities for corrosion, non-adhesion of surface coatings and bath contamination are many.

Electroplating

Electroplating. Coats of electroplate are of such dimensions that ordinary methods of measurement may in most cases be employed. However, inclusion of organic agents may have considerable effect upon the appearance of the ultimate coat. Brightening agents are of this type, and much interesting and pertinent data has been developed regarding their utilization and mechanism of operation[11].

Organic nickel brighteners are either acid inhibitors, or are compounds reducible to acid inhibitors. It has been suggested that sulfuric acid pickling efficiency tests on steel in the presence of the potential brightener are suitable means for evaluating nickel brighteners, since a reducing medium

exists, and because steel offers a suitable surface for adsorption. The active groups are quaternary salt-forming compounds such as organic sulfur or nitrogen materials which form an insulating layer on the metal.

The characteristic banded structure of bright nickel deposits appear to result from the presence of a sulfonic acid or sulfonamide. Since aryl sulfonic or aryl sulfonamide materials result in bright, ductile deposits it may be presumed that they are present in a regular manner as adsorption materials. Bright coatings are also due in part to alignment of, and control of crystal size in the order of the wavelength of light, to produce optimum reflectance of the electrodeposit. It is obvious therefore that surface active agents present in a plating bath as brighteners or anti-pitting agents may be adsorbed in extremely minute films or regularly as a portion of the deposited metal plate to produce unusual and useful results. Here again little data are available with regard to the area and length of the individual brightener molecules, but they may tentatively be deduced from analogous data available for fatty acids. Obviously, configuration of the molecule, solubility, size, and substituent groups may influence film deposits profoundly.

Surface Conversion Coatings. Visible films of phosphate salts or of oxide may be deposited on metals with the object either of preventing corrosion or promoting adhesion in a later finishing operation. Recently published information pertinent to this subject is given in Table V[10]. It will be noted that these visible films may attain considerable thickness and that they have characteristic appearance. The relative thickness of these coatings compared with thin oxide films or adsorbed films of fatty acids become clearly apparent when it is realized that 0.0001″ equals 25400 Å. The possibilities for porosity and retention of chemical salts are obviously greatly magnified, but of small consequence under ordinary conditions since the coatings themselves are protective.

Rinsing. The rinsing operation may take place in soak tanks or by spray, under which conditions greater or lesser effectiveness of removal of unwanted soluble contaminant may occur. It should be apparent that rinsing effectiveness has great bearing upon subsequent processing, the more vigorous the rinsing, the greater the removal of contaminant.

A factor oftentimes overlooked in the rinsing operation is that almost invisible films of unwanted chemical may result when the rinse piece is dried. Such film is easily apparent when a hard-water rinse is used, but less readily so, when the water is softened. However, even softened water may contain relatively high concentrations of dissolved solids which can cause water spots resulting in rejects. Consequently it may be desirable to follow the ordinary softened water rinse with a spray of de-ionized water, which is entirely free from contaminating solids.

In some operations it is permissible to utilize a final rinse containing minute amounts of either chromic or phosphoric acids, which leave a practically invisible protective film on the metal surface, thus preventing oxidation. Other operations, as just indicated, may be of such character that even these minute films are objectionable.

It should thus be apparent that not only the amount, temperature, and vigor of the rinsing is important, but that the quality of water used may prove equally if not more important.

Methods of Testing for Cleanliness. Perhaps the most widely used test for cleanliness is "water-break". According to theory, water will evenly wet the metal when the surface is perfectly clean and free from oily residue. Such a test does not take into account adsorbed hydrophilic films, so that the surface might appear clean, yet cause imperfection in subsequent treatment.

Another test used for estimation of cleanliness is acid copper plating. In this case imperfections in the cleanliness of the surface would show as resist spots, but here again adsorbed films might influence the deposition of the electroplate. It might be expected however that this would prove a more sensitive test than "water-break", especially if the metal were to be electroplated immediately following the cleaning operation.

Wiping the work with white tissue paper or cheese cloth would be useful for microscopic to macroscopic films of oil or removable colored solid matter, but neither would indicate minute films of adsorbed matter which could not be abraded and observed macroscopically.

The measurement of soil retention by fluorescence[13] under ultraviolet light has been successfully used in observing the cleanliness of surface. The minimum amount of oil detectable was said to be of the order of 0.000004 g. per square centimeter. It is evident that this is an extremely sensitive test for cleanliness, but suffers the limitation of being suitable only under photographic measurement, and then is not readily subject to quantitative treatment.

A test dependent upon removal of retained oil by a solvent and evaporation of the solution upon ground glass is said to give a sensitivity of 0.005 per cent or one part solute per 20,000 of solvent[14].

Proper application of these tests may prove valuable for the detection of trace amounts of oily or solid soils retained on metal surfaces. It is to be hoped either that more sensitive tests can be devised, or that those already available may be made more nearly quantitative in nature.

Summary

Cleanliness is a relative term, since sensitivity of measurement of retained soil may vary so greatly. Metal surfaces may vary tremendously in characteristics, and these variations will affect the ease of removal of soil and retention of cleaning composition.

Films on metal surfaces may arbitrarily be divided into three classes: 1. Macroscopic, 2. Microscopic, 3. Submicroscopic. Once the macroscopic film has been removed, the other two classes may have important, and perhaps not fully recognized effect upon processing difficulties.

Films of microscopic and submicroscopic thickness may be comprised of oxide, sulfide, carbonate, or other corrosion type films, those of surface preservatives, pickling inhibitor chemicals, soap, alkali salt, and wetting agent materials, products from vapor or emulsion degreasing baths, electroplating adjuncts, water, and surface conversion coatings. Films of these materials are important factors in the production of surfaces of desirable characteristics, but "out of sight, out of mind" is not applicable to them, because even though almost invisible, they have important bearing upon proper metal processing.

(References appeared in the August issue.)

The Effect of Various Surface Treatments in Cleaning and Preparing Copper, Nickel and Steel for Chromium Plating

Conclusion

By William M. Tucker and Robert L. Flint

The Surface Preparation of Buffed Electrolytic Copper for Chromium Plating

TABLE III contains the data observed when various methods were used to remove the thin copper oxide film normal to buffed copper. The evidence obtained indicated that oxide film removal alone was inadequate in getting maximum bright range coverage of copper. Oxide film removal plus overplating with a metal less reactive to the chromium plating bath extended the range plated to a maximum, well in line with the ranges normal to a suitably prepared but less reactive metal such as nickel or steel. Staining of the non-plated copper was normal and probably indicative of the combined phenomena of copper solution and oxide or chromate film formation. Of particular interest was the sample exposed to hot chromium plating solution. There was evidence indicating chemical solution of copper and the simultaneous formation on the copper of a mildly "passivating" film. The nature of these films and their influence on subsequently applied electrodeposits has been well reported by Muller.[15, 16]

Table IV presents the data relative to the rate at which the surface of the nickel-overplated copper cathode changed during the time elapsing before chromium plating. As would be anticipated, a marked loss of bright plate range occurred with increasing

TABLE III

The Surface Preparation of Buffed Electrolytic Copper

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning: scour with slurry of Vienna lime.

Experimental Variables	*Hull Cell Ranges in Amperes per Square Foot*				
	No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
Check—No special preparation	0-20	20-36	36-75	75-475	....
5 min. immersion at 76° C in 400 g./L CrO_3, 4 g./L SO_4 ion	0-35	35-62	....	62-475	....
Activation—5 sec. as anode 14.4 amp./sq. ft., 67 g./L CrO_3 in 1 *N* H_2SO_4, 25° C	0-20	20-45	45-75	75-475	....
30 sec. immersion at 25° C in 100 g./L NaCN	0-20	20-36	36-60	60-475	....
Activation—5 sec. at 6 volts as cathode, 240 g./L $NiCl_2.6H_2O$ in 1.1 *N* HCl, 25° C	0-30	....	....	30-475	....

TABLE IV

Deterioration of the Optimum Cathode Condition on Nickel Flashed-Buffed Electrolytic Copper

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning: scour with slurry of Vienna lime.
Strike: 10 sec. as cathode at 6 volts, 240 g./L $NiCl_2.6H_2O$ in 1.1 *N* HCl at 25° C.

Experimental Variables	*Hull Cell Ranges in Amperes per Square Foot*				
	No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
1 minute cold water immersion between strike and plating	0-20	....	....	20-475	....
2.5 minutes cold water immersion between strike and plating	0-44	44-50	....	50-475	....
5 minutes cold water immersion between strike and plating	0-72	72-100	....	100-475	....
10 minutes cold water immersion between strike and plating	0-92	92-180	....	180-475	....

TABLE V

The Surface Preparation of Buffed Electrolytic Nickel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning by scouring with slurry of Vienna lime except as noted.

Experimental Variables	*Hull Cell Ranges in Amperes per Square Foot*				
	No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
30 seconds immersion at 25° C in 11.6 *N* HCl	0-20	....	20-475	....	....
60 seconds cathodic clean in 45 g./L alkaline cleaner at 6 volts, 93° C, 10 second immersion at 25° C in 11.6 *N* HCl	0-50	....	....	50-475	....
45 seconds immersion at 25° C in 5.8 *N* HCl	0-20	....	....	20-475	....
20 seconds immersion at 25° C in 5.8 *N* HCl	0-50	50-72	....	72-475	....
5 seconds as cathode at 6 volts, 25° C in 5.8 *N* HCl	0-58	....	....	58-475	....
20 seconds as cathode at 6 volts, 25° C in 5.8 *N* HCl	0-30	....	....	30-340	340-475

time of immersion in cold water. Obviously, desirable conditions persisted for only slightly more than one minute. Exposure to hot water after overplating accelerated the decay of desirable conditions even more markedly.

The Surface Preparation of Buffed Electrolytic Nickel for Chromium Plating

Tables V, V-A and V-B present the observed results concerning the preparation of buffed electrolytic nickel for chromium plating. Almost all experienced chromium platers have from time to time been baffled by the piece of buffed or machined nickel which was covered with chromium only after numerous efforts, and then generally after considerable surface alteration and damage had occurred. Logically, the ease with which nickel reacts with oxygen should result in a maximum of eccentric behavior when chromium plating was attempted. This condition was observed to be generally true. Numerous reasonably good preparatory treatments were found. In the opinion of the authors, the best and most practical treatment was 2 minutes immersion at 25° C in 5.8 *N* H_2SO_4 (300 g./L H_2SO_4). Excellent surface preparation resulted with little or no banding or filming on the unplated, low current density end of the cathode. The more commonly used treatment of immersion in 5.8 *N* HCl (1:1 by volume) could be criticized because at less than 30 seconds immersion results were variable and at more than one minute some slight etching occurred, a factor to be considered in decorative chromium plating only. Of particular interest was the adequacy of preparation of a buffed nickel surface by anodic polishing in phosphoric-sulfuric electrolyte. Another interesting and reasonably efficient preparation was cathodic treatment in 45 g./L NaCN + 15 g./L Na_2CO_3. This action was probably due largely to the etching action of NaCN and was attended by an efficient cleaning effect. The very poor result obtained on the cathode, exposed for 5 minutes at 93° C in the chromium plating bath, strongly suggested such a treatment as a means of pre-oxidizing nickel for service exposure.

Table VI summarizes the data procured when the deterioration rate was determined for sulfuric acid-prepared buffed nickel. The degree to which desirable surface conditions persisted was most unusual because normally a behavior similar to that reported in Table IV would be expected. This behavior possibly was associated with the curiously bad results obtained when preparation of nickel was attempted in concentrated hydrochloric acid and in nickel chloride-hydrochloric acid strikes. Another interesting effect was the tendency of the chromium plate to gray-up on the high current density end of the cathode with increased time of immersion in cold water. This observation was general in the sense that it was frequently noted that inadequately prepared surfaces were inclined to plate off, *i.e.*, they were milky or gray.

Table VII presents a tabular comparison of the results observed when a conventional preparation of 20 seconds duration with 5.8 *N* HCl (1:1 by volume) and a 2-minute preparation in 5.8 *N* H_2SO_4 (300 g./L H_2SO_4)

TABLE V-A

The Surface Preparation of Buffed Electrolytic Nickel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning by scouring with slurry of Vienna lime.

Experimental Variables	*Hull Cell Ranges in Amperes per Square Foot*				
	No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
Chromium Plating Bath Treatments					
5 seconds immersion at 93° C in 400 g./L CrO_3, 4 g./L SO_4 ion	0-207	207-263	....	263-475	
5 minutes as gently gassing cathode at 38° C in 400 g./L CrO_3, 4 g./L SO_4 ion	0-50	....	....	50-475	
Chromic and Sulfuric Acids					
5 seconds as anode at 14.4 amp./sq. ft., 25° C, 67 g./L CrO_3 in 2 *N* H_2SO_4	0-44	....	....	44-475	
10 seconds as anode at 14.4 amp./sq. ft., 50° C in 2 *N* H_2SO_4	0-44	44-85	....	85-475	
1 second as cathode at 6 volts, 25° C in 5.8 *N* H_2SO_4	0-20	....	....	20-475	
2 minutes immersion at 25° C, in 5.8 *N* H_2SO_4	0-20	....	....	20-475	

TABLE V-B

The Surface Preparation of Buffed Electrolytic Nickel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning by scouring with slurry of Vienna lime except as noted.

Experimental Variables	*Hull Cell Ranges in Amperes per Square Foot*				
	No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
Misc. Media, etc.					
30 seconds immersion at 25° C in 7.8 *N* HNO_3	0-20	....	20-475	....	....
60 seconds anodic polish in phosphoric-sulfuric electrolyte	0-28	....	....	28-475	....
20 seconds as cathode at 6 volts, 25° C, 240 g./L $NiCl_2.6H_2O$ in 1.1 *N* HCl	0-30	....	....	30-314	314-475*
20 seconds as cathode at 6 volts, 25° C, 60 g./L $NiCl_2.6H_2O$ in 5.8 *N* HCl	0-30	....	....	30-314	314-475*
2 minutes as cathode at 6 volts, 25° C, 240 g./L $NiSO_4.6H_2O$ in 1 *N* H_2SO_4	0-20	20-25	....	25-475	....
60 seconds as cathode at 6 volts, 25° C in 45 g./L NaCN, 15 g./L Na_2CO_3	0-30	30-37	....	37-475	....

* Ex-foliated deposit in gray plate range.

were used on cathodes plated in chromium electrolytes of constant CrO_3 content having CrO_3:SO_4 ion ratios varying from 50:1 to 200:1. With the sulfuric acid preparation, the plating range was constant from 85:1 to 200:1 with a narrowing of 7 and 30 amp./sq. ft. (0.75 and 3.23 amp./dm.^{2}) in range at 70:1 and 50:1, respectively. The ranges obtained using hydrochloric acid-prepared cathodes were variable and not well related to the sulfate ratio of the plating bath. These data emphasize the importance of the duration of special processing and would suggest that the so frequently used "dip" in hydrochloric acid was possibly the secondary cause for a few units on an otherwise perfect rack of work to plate off in brightness.

The Surface Preparation of Buffed Cold Rolled Steel for Chromium Plating

Tables VIII, VIII-A and VIII-B summarize the observed data from the numerous experiments devoted to preparing steel for chromium plating. Steel was by far the easiest metal prepared of those studied. An adequate degree of preparation resulted from anodic treatment in a chromium plating bath; however, better results were possible using combinations of chromic acid and sulfuric acid anodically. Similar treatment in sulfuric acid alone was also very good, particularly in the case of 1 *N* H_2SO_4 at 49° C. As with nickel, proper preparation was accompanied by very broad plating ranges. For practical applications which could tolerate slight visible dulling by etching, a more prolonged anodic treatment in sulfuric acid yielded still broader plating ranges. It is important to note that steel in general was influenced to a markedly less degree than was nickel by pre-chromium plating variables.

Table IX contains a resume of the data concerning the persistence of the optimum cathode condition on steel. Evidently deterioration begins between 20 seconds and 1 minute, the interval difference between the Table VIII-A and Table IX data. The narrowing of the bright plate range was most pronounced at the high current density end, which was parallel to the observed phenomena on sulfuric acid-prepared nickel.

General Discussion

This study of the surface preparation for chromium plating of copper, nickel and steel indicated that the list of factors involved are essentially as follows:

1. Preplating removal or substantially complete removal of interfering films, generally thought to be oxides.

2. Rate of repair of these interfering films (normal for the metal in the media of exposure, *i. e.*, water, air, etc.) during the time intervening between surface preparation and start of plating.

3. Rate of formation in the plating bath of interfering chemical films presumed to be chromates or possibly oxides of either chromium or the basis metal.

4. Rate of solution of the basis metal and its oxide or other chemical film in the chromium plating bath.

5. Instantaneous current density on the more active portions of the cathode and the relationship thereof to the formation of a chromium metal deposit having a crystal structure capable of essentially specular reflectivity.

6. A definite concentration effect with regard to the true current density resulting from the observed fact that, at the initiation of plating, gas evolution always began at the high current

TABLE VI

Deterioration of the Optimum Cathode Condition on Buffed Electrolytic Nickel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning: scour with slurry of Vienna lime.
Pickling preparation: 2 min. immersion in 5.8 *N* H_2SO_4 at 25° C.

Experimental Variables	*Hull Cell Ranges in Amperes per Square Foot*				
	No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
1 minute cold water immersion between pickling and plating	0-29	....	....	29-475	....
5 minutes cold water immersion between pickling and plating	0-30	....	....	30-362	362-475
10 minutes cold water immersion between pickling and plating	0-30	....	....	30-362	362-475

TABLE VII

Comparison of Plating Ranges on Specially and Normally Prepared Buffed Electrolytic Nickel Cathodes at Various CrO_3 : SO_4 Ion Ratios

Plating bath: 400 g./L CrO_3, SO_4 ion variable.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning: scour with slurry of Vienna lime.
Pickling: immersion for 20 sec. in 5.8 *N* HCl at 25° C.
Special pickling: 2 min. immersion in 5.8 *N* H_2SO_4 at 25° C.

Ratio CrO_3:SO_4		*Hull Cell Ranges in Amperes per Square Foot*				
		No Deposit	*Non-Metallic Deposit*	*Milky Plate*	*Bright Plate*	*Gray Plate*
200:1	Normal	0-34	....	....	34-475	....
	Special	0-30	....	....	30-475	....
150:1	Normal	0-29	29-57	....	57-475	....
	Special	0-29	....	....	29-475	....
125:1	Normal	0-37	....	....	37-475	....
	Special	0-20	20-30	....	30-475	....
100:1	Normal	0-50	50-75	....	75-475	....
	Special	0-30	....	....	30-475	....
85:1	Normal	0-34	....	....	34-475	....
	Special	0-30	....	....	30-475	....
70:1	Normal	0-50	....	....	50-475	....
	Special	0-37	....	....	37-475	....
50:1	Normal	0-60	....	....	60-475	....
	Special	0-60	....	....	60-475	....

TABLE VIII

The Surface Preparation of Buffed Cold Rolled Steel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning by scouring with Vienna lime except as noted.

Experimental Variables	*Hull Cell Ranges in Amperes per Sq. Ft.*			
	No Deposit	*Milky Plate*	*Bright Plate*	*Gray Plate*
Chromium Plating Bath Treatments				
5 minutes immersion at 86° C in 400 g./L CrO_3, 4 g./L SO_4 ion	0-72	....	72-475	....
10 seconds as cathode and 15 seconds as anode at 144 amp./sq. ft., 22° C in 400 g./L CrO_3, 4 g./L SO_4 ion	0-30	....	30-475	....
10 seconds as anode at 144 amp./sq. ft., 22° C in 400 g./L CrO_3, 4 g./L SO_4 ion	0-30	....	30-475	....
Chromic and Sulfuric Acids				
5 seconds as anode at 432 amp./sq. ft., 25° C in 250 g./L CrO_3	0-30	30-382	....	382-475
5 seconds as anode at 432 amp./sq. ft., 25° C in 125 g./L CrO_3 in 0.25 *N* H_2SO_4	0-20	....	20-475	....
5 seconds as anode at 432 amp./sq. ft., 25° C in 65 g./L CrO_3 in 0.5 *N* H_2SO_4	0-20	....	20-475	....
5 seconds as anode at 432 amp./sq. ft., 25° C in 65 g./L CrO_3 in 1 *N* H_2SO_4	0-20	....	20-475	....
5 seconds as anode at 432 amp./sq. ft., 25° C in 65 g./L CrO_3 in 2 *N* H_2SO_4	0-20	....	20-305	305-475

density end of the Hull cell plate. The interface of gas evolution and the times required for gas evolution to come to equilibrium across the cathodes were variable and not of constant behavior except when the cathodes had been prepared so as to cover with chromium to the maximum degree.

7. As has been demonstrated by others, the sulfate ion in a highly acid environment possessed a specific and benevolent effect. Our data indicated sulfate ion preparation in the presence of a high concentration of hydrogen ion to be as efficient as choride ion in a similar environment and less subject to rapid deterioration.

8. The three metals w. investigated behaved individually as would be expected. However, from a practical aspect copper and steel behaved similarly in that, provided the cathode was free of grease, oils, etc., very little could be done either to narrow or widen the bright plating range. This was not the case with nickel since a choice of an improper method of cleaning or an accidentally long exposure to the chromium plating bath without current flowing could markedly reduce the width of the bright plating range. Conversely, a choice of an ideal cycle of surface preparation (capable of removing oxide and other interfering films) yielded deposits characterized by a bright plating range of unusual width. In brief, the practical operator must expect to use special precautions in the preparing of nickel for chromium plating. An unmentioned but practical approach would be to prevent nickel deposits from filming as much as possible prior to preparation for plating. Low buffing temperatures, quick processing of buffed work, utilization of nickel plating baths giving deposits requiring a minimum of buffing, etc., would be practical steps capable of minimizing difficulties with coverage. However, it would be even more practical to incorporate into every chromium plating-over-nickel cycle one of the preferred preparatory steps which can remove oxide and other interfering films residual after alkaline cleaning processes. Although bright nickel deposits were not studied, the general considerations involved would warrant at least the suggestion that similar preparatory steps be utilized.

Summary

A. Buffed copper and cold rolled steel, free of greases and oils, normally accepted chromium deposits of a satisfactory nature. Buffed nickel, similarly prepared, required special processing to obtain equally good results.

B. Some cleaning methods utilizing abrasion or electrolysis were not efficient in preparing nickel cathode surfaces and, in specific cases, actually retarded chromium coverage.

C. Copper could not be covered with chromium at as low a current density as nickel or steel except by overplating with a thin layer of nickel from a low efficiency chloride electrolyte

TABLE VIII-A

The Surface Preparation of Buffed Cold Rolled Steel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning by scouring with Vienna lime except as noted.

Experimental Variables	*Hull Cell Ranges in Amperes per Sq. Ft.*			
	No Deposit	*Milky Plate*	*Bright Plate*	*Gray Plate*
Sulfuric Acid				
5 seconds as anode at 432 amp./sq. ft., 48° C in 1 *N* H_2SO_4	0-20	....	20-475	....
5 seconds as anode at 6 volts, 25° C in 0.5 *N* H_2SO_4	0-26	....	26-362	362-475
5 seconds as anode at 432 amp./sq. ft., 59° C in 2 *N* H_2SO_4 plus 1.5 g./L inhibitor	0-30	....	....	30-475
20 seconds immersion, then 3 seconds as anode at 144 amp./sq. ft., 59° C in 2 *N* H_2SO_4	0-20	....	....	20-475
2 minutes immersion at 25° C in 5.8 *N* H_2SO_4	0-20	20-372	....	372-475
Sulfamic Acid				
2 minutes immersion at 51° C in 1 *N* sulfamic acid	0-30	....	....	30-475
5 seconds as anode at 432 amp./sq. ft., 51° C, 1 *N* sulfamic acid	0-30	....	....	30-475

TABLE VIII-B

The Surface Preparation of Buffed Cold Rolled Steel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning by scouring with Vienna lime except as noted.

Experimental Variables	*Hull Cell Ranges in Amperes per Sq. Ft.*			
	No Deposit	*Milky Plate*	*Bright Plate*	*Gray Plate*
Misc. Media, etc.				
60 seconds anodic polish in phosphoric-sulfuric electrolyte	0-50	....	....	50-475
60 seconds as cathode at 6 volts, 25° C, in 45 g./L NaCN, 15 g./L Na_2CO_3	0-50	....	50-166	166-475
20 seconds as cathode at 6 volts, 25° C, 240 g./L $NiCl_2.6H_2O$ in 1.1 *N* HCl	0-70	....	70-475	....
2 minutes as cathode at 6 volts, 25° C, 240 g./L $NiSo_4.6H_2O$ in 1 *N* H_2SO_4	0-34	....	34-390	390-475
60 seconds as anode at 6 volts, 93° C, in alkaline cleaner 45 g./L—10 second dip in 11.6 *N* HCl	0-20	....	20-365	365-475

TABLE IX

Deterioration of the Optimum Cathode Condition on Buffed Cold Rolled Steel

Plating bath: 400 g./L CrO_3, 4 g./L SO_4 ion.
Temperature: 46° C. ± 0.5° C.
Cell conditions: 10 amp. for 5 min.
Cleaning: scour with slurry of Vienna lime.
Pickling preparation: 5 sec. as anode at 6 volts in 1 *N* H_2SO_4 at 25° C.

Experimental Variables	*Hull Cell Ranges in Amperes per Sq. Ft.*			
	No Deposit	*Milky Plate*	*Bright Plate*	*Gray Plate*
1 minute cold water immersion between pickling and plating	0-26	....	26-365	365-475
5 minutes cold water immersion between pickling and plating	0-26	....	26-325	325-475
10 minutes cold water immersion between pickling and plating	0-20	....	20-260	260-475

D. Nickel surfaces were most efficiently prepared by an immersion of at least 2 minutes or a short cathode treatment at 25° C in 5.8 *N* H_2SO_4 (300 g./L H_2SO_4) or by an adequate immersion in 5.8 *N* HCl (1:1 by volume) at 25° C. Anodic polishing in phosphoric-sulfuric electrolyte was almost as effective. Cathodic treatment in 45 g./L NaCN, 15 g./L Na_2CO_3 at 25° C was adequately effective and did a reasonably good cleaning job simultaneously.

E. Steel could be advantageously prepared by subjecting it to anodic treatment in a chromium plating bath or to anodic treatment in sulfuric acid with or without chromic acid. Anodic treatment in 1 *N* H_2SO_4 between 25° C and 50° C was most effective.

F. Conventional modern methods of surface preparation prior to chromium plating were generally adequate for copper, nickel and steel, provided the operator exposed the work during cleaning for a sufficient length of time.

G. The general technic involved in the special preparatory steps appeared to provide for the substantially complete removal of any oxide or other interfering film, followed by suitably timed manipulative steps designed to initiate chromium plating before any interfering films could form.

H. The effectiveness of the sulfate ion in an environment of high hydrogen ion concentration as an oxide and interfering film solvent was further confirmed.

I. The conclusion of Haring and Barrows and others that a maximum effect in the deterioration of the bright plating range occurred at the high current density limit when interfering films began to reform on the cathode surface was well confirmed.

J. The Hull cell, when utilized with great care, was found to be capable of providing quantitative data with respect to the behavior of both differently prepared cathodes and variations in the chromium electrolyte proper.

Acknowledgment

The authors wish to express their appreciation to the Management of the Eastman Kodak Company and particularly to H. E. VanDerhoef for permission to publish the results of this investigation.

(References appeared in the August issue)

SHOP PROBLEMS

PLATING AND FINISHING
POLISHING—BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Imitation Oxidized Silver Finish

Question: I would appreciate it if you can give me a formula for a black plate on bright nickel. The basis metal is diecast zinc. I would like to have my work look like oxidized silver after it has been tumbled in a tumbling barrel with soap.

S. S.

Answer: We would suggest that you nickel plate in a die cast nickel solution and follow with an arsenic deposit. Then relieve by tumbling.

Formulas for these solutions will be found in the 1945 edition of the Plating & Finishing Guidebook, a copy of which will be forwarded to you with your subscription.

Cathode Sputtering Process

Question: We are interested in the details of the cathode sputtering process for applying metallic coatings to non-conductors. Can you furnish us with this information, or a bibliography of sources from which we can obtain the information desired?

C. B.

Answer: We suggest that you communicate with Central Scientific Company, Cambridge, Mass., who sell equipment for this purpose and will be able to furnish you with details on the process.

Aluminum Etch Control

Question: To bright dip or etch aluminum, a solution of 5% nitric acid and ½% hydrofluoric acid at 150 F. has been suggested to me.

Is it possible to control such a solution volumetrically—and can you give me an idea of how to go about it?

E. E. W.

Answer: An article on the analysis of mixtures of nitric and hydrofluoric acids appeared in the August, 1945 issue of *Metal Finishing*.

The mixtures covered in this article were used for pickling stainless steel but the procedures will probably be equally adaptable to your requirements.

Additional Shop Problem Information

The following letter from England gives a new slant on a Shop Problem appearing in the May, 1946 issue of *Metal Finishing*. It shows that English plating problems can be as difficult as ours, and gives a complete cleaning cycle for brass to improve adhesion.

27th June, 1946.

The Editor,
Metal Finishing,
West 42nd Street,
New York 18, N. Y.

Re:—Shop Problems.

Dear Sirs,

With further reference to a question by your subscriber "D.P.F.," appearing under the heading of "Poor Adhesion" on page 211 of your May issue, I am taking the liberty of appending my observations.

Your correspondent is dealing with yellow brass containing small percentages of tin, and is complaining of a blistered nickel deposit upon articles made of the above alloy. I am of the opinion that his deduction, that the fault lies in the cleaning of the basis metal, is correct, as it bears out similar experiences of our own.

It is well known that in the preparatory treatment of the bronzes and similar alloys the customary Cyanide dip must be omitted as it causes a heterogeneous surface passivation on the articles. We have found that this passivation due to a Cyanide dip does not occur in the usual commercial brasses which contain only the minutest traces of tin, but owing to the poor quality of some of the war-time materials with which we have had to deal, we have found it necessary to make a more thorough investigation on the subject and have proved conclusively that if the tin content of the alloy is in the region of 0.3% or more it is imperative that the Cyanide dip prior to Nickel Plating should be avoided.

In reply to your correspondent we would suggest the following cleaning cycle which we have practised with great success:—

1. Wash in Trichlorethylene liquor followed by vapour degreasing.
2. Cathodic treatment in a mild alkali which should not contain Caustic Soda, Tri-Sodium Phosphate, or Cyanides; we would suggest a solution of Sodium Meta- or Sesqua- Silicate, or a solution of Sodium or Potassium Aluminate, or a mixture of both. A pressure of six volts should be applied and the temperature of the electrolyte should be at least 180° F.
3. Rinse twice in clean water.
4. Dip in 5% Sulphuric Acid.
5. Rinse.
6. Nickel Plate.

Hoping that your correspondent may find these observations of some value.

Yours faithfully,

PETER BERGER.
Chief Chemist.
Wm. Bate Ltd.
Hospital Street,
WALSALL, Staffs. England.

Oxalic Acid Anodizing

Question: I would like to obtain information on oxalic acid anodizing of aluminum, including solution composition.

P. J. P.

Answer: A 3-10% solution is generally employed at 70-100° F., 40-50 volts, 12 amps./sq. ft., alternating or direct current.

THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent

OPA And Our Future The Office of Price Administration is still with us. This means another year of suspense and anticipation for a return to the normal supply and demand way of doing business. This additional year of life will not be without regulatory confusion; and toward the end of the year another period of chaos will set in for many will become panic stricken by the left-wing propagandists. And the advocates of price control will again shout from the house tops for its preservation for by that time they will have invented another emergency because after years of experience they have become skilled in the business of inventing emergencies. They are aware that emergencies are needed in their campaign to attain their divide-the-wealth objective. They drug the minds of the people with their battle-cry of "security" while they rob them of their "liberty." A review of past events will make it clear that they forced up wages to the limit by means of Government coercion and strikes, while they held prices at the lowest possible level. This is one of the methods they employ to attain the redistribution of wealth.

Is Another Emergency Ahead? Now that the Price Control Extension Act has been passed the OPA has been raising prices right and left. But that is part of the plan to create another emergency. They wish to grant a little increase in prices to fire labor leaders to demand increased wages. Labor has already revealed that it will reopen open-end labor contracts for the purpose of demanding higher wages. And then to make things interesting, Philip Murray, head of the CIO, recently declared that there must be a roll-back of prices or an end to wage increase curbs. This he tops off with the prediction that if this is not done "the stage will be set for a new depression." Now is that the emergency desired by those who seek a redistribution of wealth and permanent price control?

Price Control Exemption of New Commodities The Office of Price Administration issued Supplementary Order No. 173 on August 19, 1946 which states the qualifications and procedures for a commodity to be exempted from price control under the "new commodity" exemption provision of the Price Control Extension Act of 1946. The OPA states that a "new commodity" is one not commercially or industrially available before January 30, 1942. The Act provides that such commodities are exempt from price control if they are used in the manufacture of other commodities and bring about an increase in the life of the commodity or a reduction in its cost of production.

Legislation to Prevent Needless Strikes Will Be Considered by New Congress When Congress reconvenes in January measures will be introduced which will impose new responsibilities on unions for the purpose of providing employers with better safeguards against needless strikes. A number of amendments to the Wagner Act are being given consideration. Among them is an amendment which will eliminate foremen's unions from protection of the Wagner Act. Many feel that employers should have the right to speak freely to their employees on subjects which are now banned by the NLRB.

The American Way of Life Is Worth Preserving Not long ago the United States News made a comparison of United States prices and wages with those in Russia. The study revealed that the average factory worker in the United States earns $200 a month as compared with $135 a month in Russia. The low cost men's suits in the United States run from $21 to $53; but in Russia the base price is $133. Women's street dresses that cost from $5.50 to $25 in the United States, cost $125 to $183 in Russia. Men's shoes that cost $5 to $9 in the United States cost $156 to $308 in Russia. Woolen sweaters that cost Americans $2.25 to $6.00 cost the Russians $20 to $83. This is evidence that for a working man captalistic United States is a paradise in comparison with communistic Russia.

Two New Techniques For Electrolytic Metal Polishing Two new techniques for electrolytic metal polishing were developed at the Ordnance Laboratory of the Frankford Arsenal at Philadelphia. The new methods are claimed to give more rapid results, to require less skill than mechanical polishing, and to prevent "flowed" or "worked" layers in polished surfaces. One of the new techniques involves the use of a portable brush electrode for polishing individual areas of heavy and cumbersome objects which do not lend themselves to mechanical treatment or to electrolytic polishing in a tank. The brush electrode is made of a metallic core enveloped in a solution-retentive dielectric material. This principle of brush polishing led to the development of a second technique—an "electrolytic lapping" process, for polishing metallographic specimens. This method uses a stationary lapping disc of similar construction to the brush electrode. In this second method the object to be polished is made anode and moved over the disc, which is moistened with the electrolyte. A complete description of both methods may be had from the Office of Technical Services of the Department of Commerce for $2.00 by ordering report PB-4052.

Electroplating Equipment Shipments And Unfilled Orders The Bureau of Census of the Department of Commerce reports that during the month of May 1946 the shipments of electroplating and anodizing equipment totaled $661,000; and that the unfilled orders for this type of equipment on May 31, 1946, amounted to $2,073,000.

A Device For Measuring Coating Thicknesses A magnetic gage for measuring the thickness of thin coatings on steel, which was developed by the Frankford Arsenal at Philadelphia, is described in a report (PB-200,054; price $2.00), for sale by the Office of Technical Services, Department of Commerce. The device consists of a solenoid containing a soft, movable iron core, and equipped with a suitable indicator scale. An alternating current is used to energize the solenoid. The maximum error of the device is said to range from plus or minus five per cent for films 0.002 inches thick.

Treasury Silver Disposition On July 31, 1946 the Treasury Department revealed that during the period July 1, 1940 and June 30, 1946, it had acquired 308,715,209 ounces of silver and that on July 1, 1946, it had on hand 1,285,112,204 ounces of silver. During the period July 1, 1940, and June 30, 1946, the Treasury Department sold from "silver ordinary" stock for miscellaneous purposes 4,600,000 ounces; under the terms of the Act of July 12, 1943, as amended, it sold 140,617,187 ounces; and that it leased to the Defense Plant Corporation, etc., 952,651,909 ounces of silver. This makes a total of 1,097,869,386 ounces sold and leased for industrial purposes within the United States. Out of the total silver leased to the Defense Plant Corporations, etc., a total of 74,936,795 ounces have been returned, leaving a

balance due of 877,715,175 ounces. Under lend-lease the Treasury Department has issued to foreign governments during the period March 11, 1941, and June 30, 1946, and still outstanding, a total of 410,814,344 ounces. Out of this total lend-lease of silver 11,733,093 ounces went to Australia; 261,333 ounces to Belgium; 5,425,000 ounces to Ethiopia; 196,364 ounces to Fiji; 225,999,904 ounces to India; 56,737,341 ounces to Netherlands; 22,347,431 ounces to Saudi-Arabia, and 88,073,878 ounces to the United Kingdom.

Arnold Now Assistant to Wallace for Small Business Laurence F. Arnold, former director of the Office of Small Business of the Department of Commerce has been appointed Assistant to the Secretary of Commerce for Small Business. "In this new capacity," Secretary Henry A. Wallace said, "Mr. Arnold will be responsible for generally giving leadership to and coordinating the small business activities of the Department, including not only the activities of the Office of Small Business, but those of other bureaus and offices which are making contributions to the small business program of the Department."

Income Tax Payments Falling The Department of Commerce reports that during the first six months of 1946 the total income tax payments of the United States totalled $78,456,000,000 as compared with $80,212,000,000 for the same period in 1945 and with $36,563,000,000 for the first six months of 1940.

When a Time Clock Is Not a Time Clock Employers have been given something to think about for the United States Supreme Court has ruled that "it is generally recognized that time clocks do not necessarily record the actual time worked by employees. Where the employee is required to be on the premises or on duty at a different time or where the payroll records or other facts indicate that work starts at an earlier or later period the time clock records are not controlling. Only when they accurately reflect the period worked can they be used as an appropriate measurement of the hours worked." It also ruled that "unless the employer can provide accurate estimates, it is the duty of the trier of facts to draw whatever reasonable inferences can be drawn from the employees' evidence as to the amount of time spent in these activities in excess of the productive working time." In other words, the Court has ruled that the statutory work-week includes all time during which an employee is required to be on the employer's premises. The thing which will trouble many is: what is "reasonable inferences"? Will this open suits for new wage claims?

Government Will Continue to Buy Foreign Non-Ferrous Metals Which Are Scarce Reconversion Director John R. Steelman announced recently that the Government's program for the importation of scarce non-ferrous metal ores and concentrates will continue on the same basis that prevailed on June 29th of this year. In other words, the Metal Reserves Corporation of the RFC will continue to buy foreign metal ores and concentrates at the lowest possible price and then resell the ores and concentrates in the domestic market at prices which will enable refiners to operate within OPA prices. Any losses incurred under this import program is absorbed by the Government.

Prospective Employers Should Get a Copy of the Commerce Department's Latest Publication The Department of Commerce has just brought out a publication called: "One Hundred Questions to Be Considered in Establishing A Small Manufacturing Business." This publication which can be had for the mere asking should be read by everyone contemplating engaging in the metal finishing business even though it is intended primarily for prospective manufacturers. It has a lot of valuable hints on such topics as organization, financing, markets, plant construction, equipment and layout, purchasing methods, labor, records, costs, pricing, technical developments and legal advice.

Nickels Are Again Made With Nickel Mint Director Nellie Taylor Ross recently announced that nickels are being coined on the prewar basis of 25 per cent nickel and 75 per cent copper. During the war nickels were made of 35 per cent silver, 56 per cent copper and 9 per cent manganese.

Government Stockpile of Copper Shrinking Fast Government experts are of the opinion that domestic production of copper will require a year of time to pick up the slack caused by four and one-half months of strikes. The Government stockpile of copper has declined from 636,000 tons on January 1, 1946, to 275,000 tons on July 31, 1946.

Nickel Sales Decline Chairman and president Robert C. Stanley of the International Nickel Company of Canada, Limited, and subsidiary companies, recently revealed that nickel sales for the first six months of 1946 dropped to 73 per cent of the total sales for the first half of 1945.

Tinplate Export Quota Increased The Civilian Production Administration has fixed the fourth quarter allocations of tinplate for export at 136,000 tons. This is an increase of 24,000 tons when compared with the third quarter of 1946.

$75,000,000 Worth of Metals to Be Sold by WAA By the middle of September the War Assets Administration expects to make available about $75,000,000 worth of Government-owned metals and metallic scrap such as aluminum, copper, copper wire, copper base alloys and other metals.

Nonferrous Metal Products Shipments According to the latest available reports of the Department of Commerce's Census Bureau there was shipped during the month of May, 1946, a total of $18,389,000 worth of jewelry, silverware and plated ware; $12,373,000 worth of watches and clocks; $1,426,000 worth of engraving, plating and polishing; $16,424,000 worth of non-ferrous lighting fixtures, and $4,309,000 worth of miscellaneous non-ferrous metal products.

Zinc Price Regulation Expected By the time this is in print the Office of Price Administration will have reached a decision on the price of zinc. The present discussions between OPA and zinc producers hinge on the dissatisfaction of the primary zinc producers with the 8¼ cents ceiling on zinc when world prices on zinc are rising.

Sulphate of Ammonia Price Increased The Office of Price Administration has increased the ceiling price of sulphate of ammonia by setting the new price at $30 per ton, in bulk.

Platinum Prices Rising Because of the heavy demand for platinum by the jewelry industry the price of this metal has been increasing. Russian platinum is expected to be imported to help supply the demand for this metal.

Cadmium Price May Increase Producers of cadmium are of the opinion that the current shortage will be of indefinite duration because of the low production of lead and zinc—of which it is a by-product. The Government stocks of cadmium is threatened with extinction. The price of cadmium may increase slightly.

Copper Fixed at 14⅜ Cents The Office of Price Administration recently fixed a price of 14⅜ cents a pound as the maximum base price for electrolytic, lake and other kinds of copper delivered in carload lots at Connecticut Valley points.

Zinc May Become Scarce Because of Price Dispute Because of the price dispute between the Office of Price Administration and the zinc producers, large scale shutdowns and a drastic curtailment of available zinc to its consuming industries may result.

Zinc Production Improving During the month of July 1946 the downward trend of zinc production was arrested when the volume of production was 59,014 tons as compared with 58,812 tons in June, 1946, and with 62,416 tons in May, 1946. The American Zinc Institute also revealed that the stock of zinc had fallen from 239,953 tons in June to 229,746 tons in July.

Normal Tin Production Slow in Recovery John J. Croston, special investigator for the Civilian Production Administration recently reported that only 41,000 tons of tin were found in the Orient. He does not believe the world output of tin will be normal before 1949, because of the poor conditions of the mines and the unrest in the Far East.

Copper Production Increasing The Copper Institute reports that the production of crude copper totaled 56,264 tons in July 1946 as compared with 32,785 tons in June, 1946. Refined copper production rose from 23,870 tons in June, 1946, to 43,606 tons in July, 1946.

Metal Working Firms Relieved of Reporting in Form 732 The Civilian Production Administration announced recently that metalworking firms are no longer required to fill out "Form 732." This should be good news.

June Chemical Production The Bureau of Census of the Department of Commerce reports that during the month of June 1946 there was produced 60,609 short tons of synthetic anhydrous ammonia; 43,124 short tons of calcium carbide; 10,903,000 pounds of calcium phosphate; 78,000,000 pounds of carbon dioxide; 96,420 short tons of chlorine; 27,438 short tons of hydrochloric acid; 3,334,000 pounds of hydrofluoric acid; 198,000 gallons of methanol; 55,416 short tons of nitric acid; 137,000 short tons of phosphoric acid; 582,000 short tons of soda ash; 13,355 short tons of sodium bicarbonate; 177,000 short tons of sodium hydroxide; 18,000 short tons of sodium phosphate; 34,912 short tons of sodium silicate; 100,000 short tons of sodium sulfate, and 1,923,000 short tons of sulfuric acid.

WAA Establishes Branch to Aid Small Business Men To aid small business men in buying surplus property, the War Assets Administration has established a Small Business Branch in its Office of Plans and Policies. The head of this branch is John M. Frier.

Tin Export Taxes Waived in Bolivia The Department of Commerce reports that "all taxes on tin exported from Bolivia valued over the base price of 62½ cents per pound have been waived by the Bolivian Ministry of Bolivia."

Lead Situation Restrictions of consumption of lead under Order M-38 resulted in decreased allocations during the first quarter of 1946 when compared with the same quarter in 1945. The supply of this metal has become critical. This is due to manpower shortage and the 50 per cent reduction in imports of this metal. Domestic production of lead has declined steadily from 447,056 short tons in 1942 to 386,561 short tons in 1945. To stimulate domestic lead production, especially the poorer ore reserves, the Premium Price Plan is being continued until June 30, 1947.

Non-Ferous Metals in Sub-Zero Temperatures A 591 page report, (PB-19793; Price $40.00), has been issued by the Office of Technical Services of the Department of Commerce which presents comprehensive data on the low-temperature properties of ferrous and non-ferrous metal alloys. The report states that ferrous materials increase in hardness, tensile strength and yield point at sub-zero temperatures, but that they show a decrease in value for reduction of area, elongation and impact resistance. The physical properties of non-ferrous materials at room temperatures are either maintained or improved at sub-zero temperatures. The most outstanding element which aids in maintaining good impact resistance at low temperature is nickel. Copper is beneficial, but it is not as satisfactory as nickel.

Report on New High Temperature Solder Available The Office of Technical Services of the Department of Commerce is selling Report PB-23086 for one dollar —a report which describes a German silver magnesium solder capable of withstanding the high temperatures inside of gas jet turbines. The solder is said to be 85 per cent commercially pure silver and 15 per cent magnesium. The solder has a melting point of 1790 degrees Fahrenheit; and it retains high strength at temperatures up to 850 degrees Fahrenheit.

10,000,000 Pound Capacity Aluminum Plant for Sale The War Assets Administration is offering to sell the government-owned aluminum rod and bar mill located near Newark, Ohio. All land, buildings and equipment are offered for sale.

Consumption of Titanium Dioxide Increasing The Civilian Production Administration reports that the domestic consumption of titanium dioxide during the year 1945 totaled 196,806 short tons as compared with 189,312 short tons in 1944, and with 159,319 short tons in 1943.

Boron Increases Hardness Report PB-16076, issued by the Office of Technical Services of the Department of Commerce, describes how small quantities of boron added to certain steel alloys, or used to partially replace molybdenum, increases the hardness of the alloys. This 67-page report, which may be had for $5.00, is illustrated with tables, graphs and photographs.

Committee Discusses Direction 9 to Order M-21 Members of the Tin Plate Industry Advisory Committee of the Civilian Production Administration at their August meeting expressed the opinion that the tin mill products order channeling 85 per cent of these materials into the making of cans and closures for perishable foods, pharmaceuticals and other so-called "A" cans should not be continued.

Combined Tin Committee Will Soon Allocate Tin Data is being gathered by the United States Operating Committee of the Combined Tin Committee preparatory to making interim allocation for the second half of 1946. All member countries of the Combined Tin Committee requesting allocations of tin must supply pertinent information on stocks, consumption and forward requirements.

Tin Situation Because of political unrest, the cost of equipment, and other factors, are slowing up the normal production of tin in the Far East. In fact it is the opinion of experts that a normal adequate supply of tin required by industry will not be available until sometime in 1948.

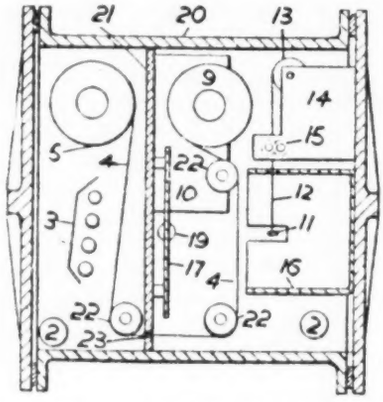
Zinc Shortage Acute The production of galvanized steel is expected to slow up during the second half of 1946 because of the current shortage of top grade zinc. For example the current demand for special high grade zinc and Prime Western Zinc for the second half of 1946 is said to be about 510,000 tons and the available supply is said to be only 465,000 tons,—or a shortage of 45,000 tons.

Federal Stock of Lead Shrinking At a recent meeting of the Primary Lead Distributors Industry Advisory Committee of the Civilian Production Administration it was revealed that the imports of lead during the month of July will be about 8,700 tons as compared with 6,000 tons in June 1946. Current Federal stocks were said to be about 38,000 tons as compared with 100,000 tons at the first of the year.

Patents

Vacuum Metallizing

U. S. Pat. 2,402,269. P. Alexander and E. L. Cranstone, assignors to Vapco Ltd. (England), June 18, 1946. The process of depositing a film of one of the metals of a group



consisting of aluminium and magnesium with a bright surface upon a support of moisture absorbent material in sheet form, characterized by continuously passing a sheet of moisture containing absorbent material past a heating unit in a vacuum chamber at such a rate and in such close proximity thereto that an exposed surface only of the sheet, which is the surface to be coated, is superficially heated to remove moisture from said surface and without heating the body of the material sufficiently to effect appreciable drying thereof, and thereafter, without appreciable prolonged exposure to the atmospheric air, continuously moving said sheet in a vacuum chamber and effecting the deposition of the metal by thermal evaporation on said moisture free surface, while preventing appreciable deposition of the metal on the opposite surface of the sheet.

Tarnish Prevention

U. S. Pat. 2,400,785. J. B. Rust, assignor to Montclair Research Corp., May 21, 1946. A process for protecting silverware from tarnishing which comprises applying to the surface thereof a dilute aqueous solution of a water-soluble product of the partial neutralization of a polyethylene polyamine by a fatty acid of more than 10 carbon atoms, removing the water therefrom and buffing the surface.

Tarnish Prevention

U. S. Pat. 2,400,786. J. B. Rust, assignor to Montclair Research Corp., May 21, 1946. A process for protecting silverware from tarnishing which comprises applying to the surface thereof a dilute aqueous solution of a fatty acid salt of a compound selected from the group consisting of guanidine and substituted guanidines, removing the water therefrom and buffing the surface, the fatty acid of the salt containing more than 10 carbon atoms.

Bright Nickel Bath

U. S. Pat. 2,401,428. M. Kosmin, assignor to Monsanto Chem. Co., June 4, 1946. A nickel plating bath comprising essentially a water solution of nickel sulfate, nickel chloride and boric acid, containing as an organic brightening agent a mixture of polysulfonates of isomeric biphenyl benzenes, said agent being present in amount up to 3.5% by weight of said solution.

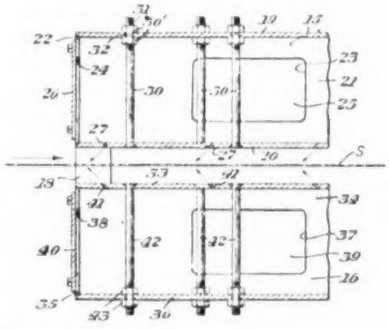
Pickling Solution

U. S. Pat. 2,402,596. E. K. Bolton, assignor to E. I. duPont de Nemours & Co., June 25, 1946. A highly ionized mineral pickle acid solution having incorporated therein from about 0.01% to about 2.5% by weight of the acid solution of an aliphatic polyhydroxythiol containing at least 4 carbon atoms and having a configuration corresponding to that of a monose sugar.

The process for repressing the corrosive attack of acidic solutions on metals containing iron which comprises adding to said solutions from about 0.01% to about 2.5% by weight of the acid solution of 1-thiosorbitol.

Strip Drying Apparatus

U. S. Pat. 2,402,545. G. S. Frum, assignor to National Steel Corp., June 25, 1946. Apparatus of the character described comprising a chamber formed of top, bottom, side and end walls, one of said walls having a plurality of spaced, substantially parallel



slots extending through the wall at an angle to the plane of the wall, each of said slots having leg portions which extend angularly with respect to the adjacent side wall and toward an end wall, the leg portions being joined together to form a continuous slot, means for moving portions of said wall adjacent the slots out of the general plane of the wall and maintaining them deflected to adjust the size of the openings formed by the slots, and means for supplying a fluid to said chamber and for causing it to be discharged therefrom through said slots.

Nickel Bath

U. S. Pat. 2,402,801. H. Brown, assignor to The Udylite Corp., June 25, 1946. A bath for electrodepositing ductile bright nickel plate comprising an aqueous acid nickel solution comprising essentially a material selected from the group consisting of nickel sulfate, nickel chloride, a mixture of nickel sulfamate and nickel chloride, a mixture of nickel sulfamate, nickel chloride and nickel sulfate, and a mixture of nickel sulfate and nickel chloride, said solution having dissolved therein thallium sulfate in an amount falling within a range of from .1 gram per liter to 2 grams per liter and an aryl organic compound containing the group

where the sulfur is positive valent and attached to at least one oxygen radical, the said bath having a pH falling within a range of from 2.5 to 4.5.

Tin Bath

U. S. Pat. 2,402,185. E. W. Schweikher, assignor to E. I. duPont de Nemours & Co., June 18, 1946. In a process for the electrodeposition of tin the step comprising effecting deposition from an aqueous acid solution of a stannous compound which contains from about 0.005 to 5.0 grams per liter of an alkali thiocyanate and from about 0.005 to 5.0 grams per liter of a soluble compound selected from the group consisting of alkali ferricyanides and alkali ferrocyanides.

Detergent

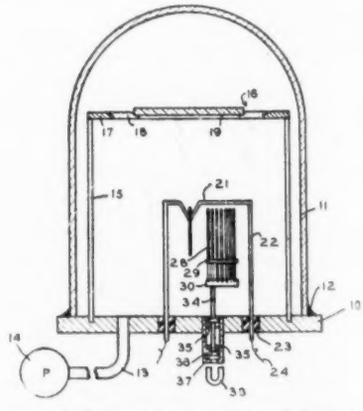
U. S. Pat. 2,402,657. M. J. Myers, June 25, 1946. The process for the preparation of a detergent composition non-irritating to skin and characterized by having a flash point not lower than 115°-120° F. which comprises mixing five gallons of kerosene and one-fourth pound of anhydrous caustic soda, heating the mixture to a temperature of approximately 200° F. for a period of two hours.

Corrosion Prevention

U. S. Pat. 2,403,067. P. W. Fischer and V. N. Jenkins, assignors to Union Oil Co. of California, July 2, 1946. A non-aqueous anti-corrosion composition comprising mineral oil in which is dissolved in the order of 0.001% to 2.0% of a material containing an oil-soluble alkanol amide of an unsaturated non-hydroxy fatty acid, the alkanol constituent containing at least four carbon atoms and the fatty acid constituent containing at least ten carbon atoms.

Vapor Metallizing

U. S. Pat. 2,403,199. J. E. Swope, Jr., A. F. Turner and O. A. Ullrich, Jr., assignors

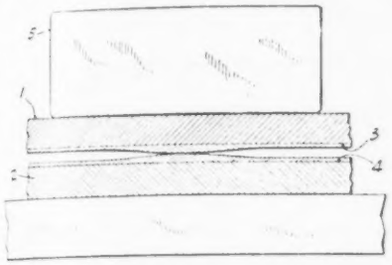


to Bausch & Lomb Optical Co., July 2, 1946. In an apparatus of the type described, an evacuable container; means for evacuating said container; means within said container for supporting a body to receive a film; a heating filament; means for movably supporting a plurality of rods of vaporizable material adjacent said filament; and means

for moving said supporting means whereby the upper ends of said rods can be seriately moved into contact with said filament.

Joining Porcelain Enameled Products

U. S. Pat. 2,403,079. W. W. Higgins, assignor to A. O. Smith Corp., July 2, 1946.



The method of joining metal members by a fused ceramic material bonded to their opposed adjacent surfaces, comprising coating the said surfaces of the members with ceramic enamel with the outer surfaces of the coatings curved relatively to effect a substantially restricted initial contact therebetween when assembled for joining, assembling said members with the enamel coatings in pressure contact, and heating the members to effect softening of the enamel with attendant progressive increase in the area of contact therebetween to thereby interfuse said coatings substantially free from gas bubbles at the juncture.

Phosphate Treatment

U. S. Pat. 2,403,426. A. Douty and G. C. Romig, assignors to American Chemical Paint Co., July 2, 1946. In the art of finishing ferrous metal surfaces, the method which includes treating the surface with a composition which consists essentially of an aqueous solution of both primary and secondary phosphates from the class which consists of alkali metals and ammonium, the pH of which lies between 4.7 and 6.5 and is greater than that corresponding to the monobasic phosphate present alone and lower than that corresponding to the dibasic phosphate present alone, rinsing the surface so treated with a dilute aqueous solution containing chromic acid having a pH in the range 2.0 to 4.6, inclusive, and containing no more soluble salt than corresponds to the metal equivalent of 30 oz. of sodium dihydrogen phosphate per 100 gallons, drying the rinsed surface and then applying a siccative finishing coat to the dry surface.

Rust Preventive

U. S. Pat. 2,402,793. C. N. White, M. L. Schwartz and G. F. Rouault, assignors to Standard Oil Co., June 25, 1946. An aqueous, substantially oil-free composition adapted to inhibit fingerprint corrosion of metals comprising a dispersion of about 5 to about 40% of a preferentially oil-soluble detergent, about 0.01 to about 10% of a water soluble antirust agent, about 2 to about 25% of a volatile organic solvent boiling below 350° F. at atmospheric pressure, and about 50 to about 80% of water.

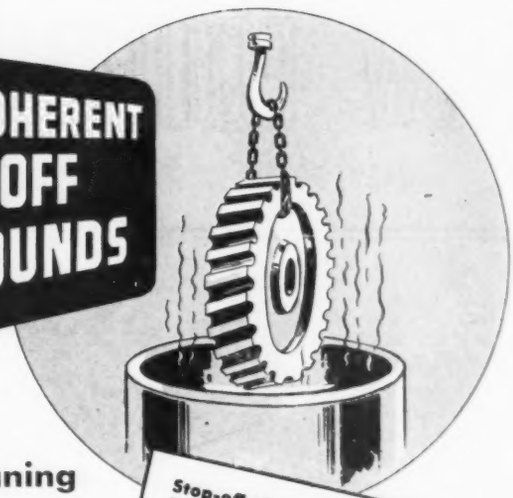
Roughness Testing

U. S. Pat. 2,402,926. H. K. Herschman, June 25, 1946. The improvement in the art of comparing the roughness of finished surfaces from transparent replicas of said surfaces, which comprises directing light through a transparent surface replica upon a photoelectrically responsive means while effecting a movement of said replica with respect to said responsive means and reading the average of the variations of the instantaneous values of the photoelectric current between a minimum and a maximum value, such variations being a function of the contour of the replica and hence of the roughness of the surface, and comparing such reading with a reading obtained in the same manner from a replica of another surface.

Pickling Inhibitor

U. S. Pat. 2,403,153. A. J. Saukaitis, assignor to American Chemical Paint Co., July 2, 1946. As a material for inhibiting the attack of acid solutions on metal surfaces, the organic reaction product formed by heating to effect chemical interaction among the following materials; an organic chloride chosen from the group consisting of ethylene dichloride, propylene dichloride, dichloroethyl ether, dichloroisopropyl ether, triglycol dichloride, tetraglycol dichloride, benzyl chloride, and naphthyl methyl chloride; a cyclic coal tar base; and a substance chosen from the group consisting of water-soluble inorganic thiocyanates and thiourea; the proportions of the said reactants being chosen so that approximately one gram atom of basic nitrogen is added in the form of the said coal tar base, and approximately one gram equivalent, in the aggregate, of the groups thiocyanate (CNS) and thiourea (SC $(NH_2)_2$) is added in the form of a substance chosen from said group of water-soluble inorganic thiocyanates and thiourea, for each gram atom of chlorine added, in the form of the said organic chloride.

3 EXTRA ADHERENT STOP-OFF COMPOUNDS



That Stand Up through both Cleaning and Plating Cycles

Unichrome Stop-off Compounds are quick-hardening, wax-like materials, readily applied by dipping. The melted compounds build up tough, durable coatings on the double-quick—coatings that stand up through the most severe cleaning and plating cycles, even on sharp edges and corners. The stop-off can be easily peeled from areas to be plated.

These stop-offs reflect years of research by the Unichrome laboratories, and are based on a thorough knowledge of actual plating-room problems. Three different formulations enable you to select a compound exactly suited to your cleaning and plating cycles.

For complete information, write today to your nearest United Chromium office listed below.

Stop-off Compound 311 (black). Excellent for the toughest jobs—withstands temperatures up to 245° F, and is not affected by acid dips or alkaline cleaners. Can be removed with a solvent, or by heating.

Stop-off Compound 314 (brown). Excellent for chromium, copper, and other plating work involving temperatures below 160° F. Can be removed by immersing in boiling water.

Stop-off Compound 315 (brown). Generally used for mixing with Compound 314 to obtain a higher softening point—between 160° F and 180° F.

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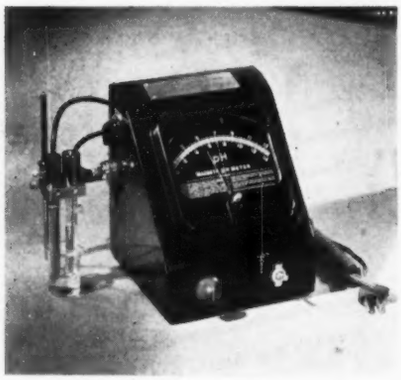
NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Line-Operated pH Meter

A new low-cost pH meter, designed for use in plants and laboratories, is announced by the Macbeth Corp., Dept. MF, 227 W. 17th St., New York 11, N. Y. The instrument is claimed to be the first dependable, inexpensive, continuous-indicating, direct-reading pH meter on the market.

The meter is an electronic device with only one operating control, which is adjusted initially in standardizing the pH with a buffer solution. An index pointer is made part of the equipment so that any shift can be detected and immediate reference can again be made to the buffer solution, thus making an automatic adjustment check between each reading.



The accuracy of the instrument is stated to be .1 pH and its sensitivity .05 pH. The meter can be left on continuously and it is reported that it drifts only .1 to .2 pH in twenty-four hours.

It is designed to operate on 115 volt, 50 or 60 cycle a.c. line and is equipped with a voltage regulator, compensating for fluctuations between 105 and 130 volts.

The glass electrodes are of the shielded type and are mounted on a plastic block with only one lead to the meter. The electrodes can be used in temperatures up to 50 degrees C., but should the meter be operated continuously at a higher or lower temperature than 25 degrees C., a sensitivity adjustment is accessible for temperature compensation.

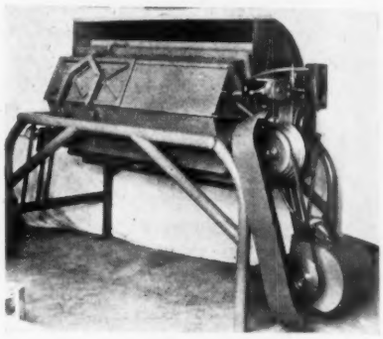
The instrument is made to operate from 0 to 14 pH, and has a swinging type needle for continuous indicating. By using a conversion factor to millivolts, oxidation-reduction measurements can be made.

Further information is available by writing to the company.

Wet Tumbler

A new relatively lightweight heavy duty wet tumbler is being offered by Almco. The equipment is designed for deburring and general tumbling operations, and is combined with the Honiting process. It is claimed that with Almco equipment and the Honiting process, parts of the softest aluminum or the hardest steel may be deburred and finished with equally good results.

The tumbler has a welded steel octagon barrel, complete with protective guard rail and safety hood, and has an electric power screen and pan to operate directly under the barrel. The compartment doors are designed to be watertight and are placed on alternate sides for balance; several sizes of barrels are available containing one to five separate compartments measuring from 9½" x 30" up to 60" x 30". Power is supplied according to size by 2 h.p., 3 h.p. or 5 h.p., three-phase motors with 4-speed cone V-belt pulley drive.



The electric screening unit separates the work load directly as it flows from the barrel opening. Interchangeable screens in a wide range of sizes from 1/16" mesh to 2" mesh are available. The hoist pan fits under the screening unit and is also used in conjunction with a self-dumping electric hoisting unit of 500-pound capacity.

Complete specifications and prices may be had by writing to Almco, Inc., Dept. MF, 556 High St., Newark, N. J.

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Any plating solution analyzed for 50c. We also sell all reagent solutions for analyzing.

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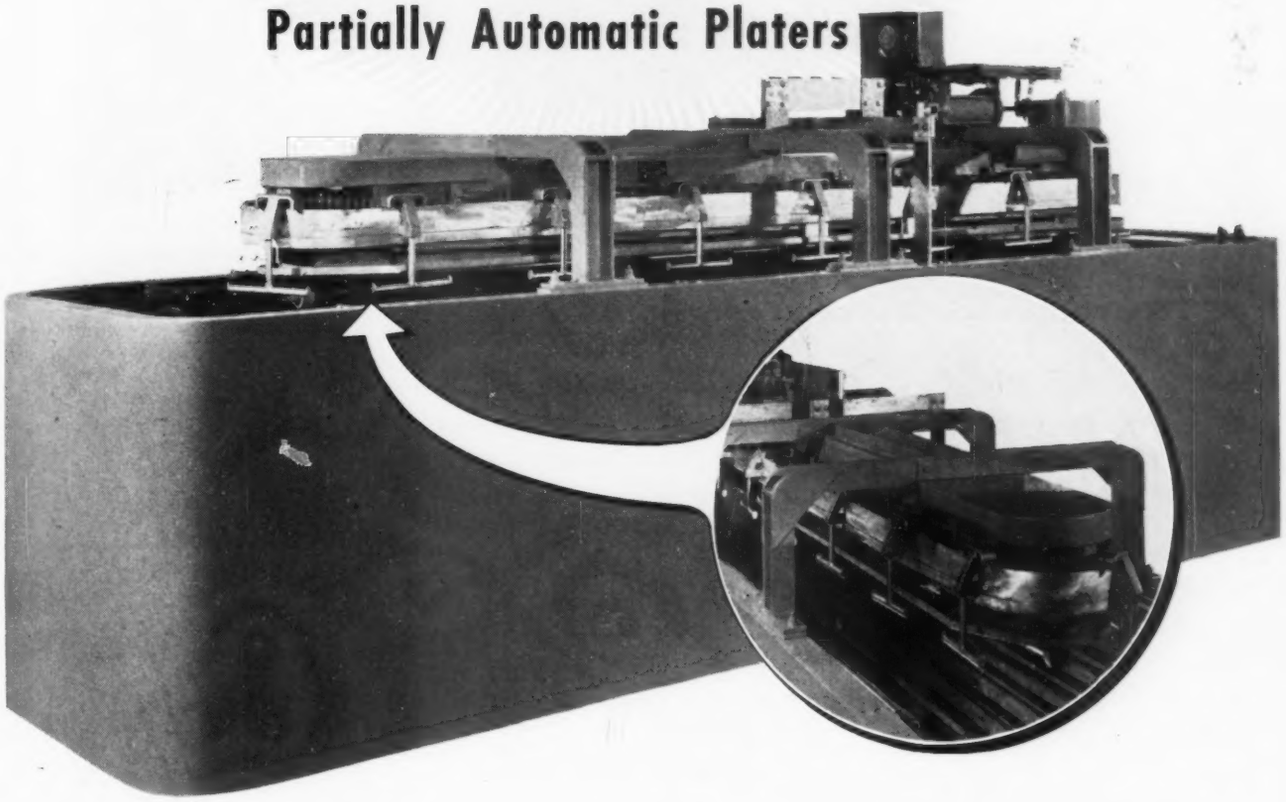
Industrial Advisory Company

SOUTH NORWALK, CONN.

for Bright Nickel

CROWN

Partially Automatic Platers



INSTANTLY ADJUSTABLE:—The work travel speed and the reciprocating motion are adjustable, making this the ideal unit for Bright Nickel and other high current density plating.

EASILY REVERSED:—By means of Crown's "finger tip control" the machine can be immediately set to travel in either direction.

SPECIAL FEATURES:—The Crown partially automatic unit alone offers these exclusive features:

Reciprocating motion or—
One direction operation only if desired by simply removing the "Reciprocator"

"Finger Tip Control" (for Reversing)

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The OPTIMUS Rack Type Washing Machine is designed for continuous handling of large numbers of metal parts on racks before plating, painting, or any similar process. Machine output is high—60 racks per hour is a common figure.

This machine can be used as a single stage washer, or it will handle a number of successive operations, alkaline, acid or neutral. With slight alterations, a series of different problems can be handled, such as washing, rinsing, drying, pickling, cyanide treatment, etc. One of the greatest uses is for removing buffing compositions.

Any plateable part can be washed as long as it is free-draining, and sprays have free access to the parts on the racks. Machine works closed and may be connected to exhaust blower, so fumes, unpleasant odors or excessive heat are not developed. Unit can be heated by steam, gas or electricity.

OPTIMUS Washing, Rinsing, Pickling and Drying Equipment and accompanying Dependable OPTIMUS Detergents can help speed up your operations. Write for details.

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Write today on your business letterhead for your copy of new illustrated bulletin No. 6E1, describing OPTIMUS Equipment and Dependable OPTIMUS Detergents for modern metal parts cleaning operations.

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ENGINEERS AND MANUFACTURERS

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STANDARD AND SPECIAL TYPES OF EQUIPMENT FROM THE SMALLEST TO THE LARGEST SIZES FOR A WIDE VARIETY OF OPERATIONS.

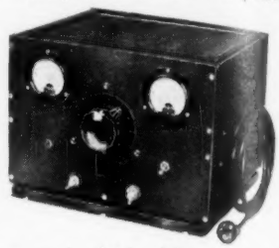
OPTIMUS EQUIPMENT

FOR WASHING · RINSING · PICKLING AND DRYING OF METAL PARTS

New Line of Rectifiers

Electro-Tech Equipment Co., 119 Lafayette St., New York 13, N. Y., announces a new line of rectifiers with the following features and specifications:

Variable DC voltage is obtained by rotating large knob located on front panel, and selected voltage is indicated on large (3¼") DC voltmeter; instantaneous DC power without warm up is obtained by merely plugging into the 110V AC source.



The unit is economical to operate and is conservatively rated. Construction features include the following: convection cooled, conservatively rated, full wave bridge selenium rectifier; powerstat continuously variable voltage control from zero to maximum; DC ammeter to indicate output current (size 3½"); voltmeter to read output DC voltage (size 3½"); panel mounted fuse; on and off switch; pilot lamp; rubber cord, and plug.

Specifications of leading models are as follows: No. 101, input 115V, 60 cycles; output 12V DC, capacity 25 amps; overall size 10" x 14" x 11¾". No. 102, input 115V, 60 cycles; output 12V DC, capacity 50 amps; overall size 10" x 14" x 11¾". No. 103, input 115V, 60 cycles; output 8V DC, capacity 150 amps; overall size 28" x 16" x 13½". All models are continuously variable.

For full information write to the manufacturer: Electro-Tech Equipment Co., Dept. MF, 119 Lafayette St., New York 13, N. Y.

New Type Rhodium Plating

The development of rhodium plating of an improved quality has been announced by P. R. Mallory & Co., Inc., Dept. MF, Indianapolis, Ind.

It is now possible to obtain unusually heavy deposits, with the desirable hardness, brilliance and corrosion resistance inherent in metallic rhodium. At the same time, the improved Mallory process assures freedom from shadows, pin holes and blisters which normally accompany heavier coatings.

Perfection of the rhodium plating process provides an enlarged field for this unusual metal in both the jewelry and metal finishing fields.

New Carriers

Rolock, Inc., Dept. MF, Fairfield, Conn., announces several distinctly new designs that are being currently produced for the metal handling industries.

Of outstanding interest is an acid cleaning and surface treating coil heated tank. This stainless steel tank, made for specific purposes, embraces the most modern design. It treats the surfaces of brass parts to give them the maximum cohesion when pressure molded to rubber. Large and strongly made, this reinforced tank is 5' x 1' 8" x 2' 6" deep.

The style A O Inconel basket is a newly

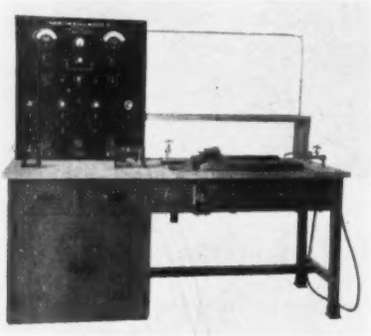
perfected finish of the more or less standard all around "basket of a thousand uses." It provides for the efficient and safe handling of average loads in many different kinds of processing operations. Strength, ease of repair and minimum welding combine in this basket carrier to give it a long service life at lowest hourly costs.

Entirely new, too, in the Rolock line is a Monel Satin Finish Laboratory Sink. The craftsmanship that goes into the manufacture of this sink, equipped with removable screen drain guard, is evident in its smart appearance. The Rolock plant is fully equipped in all phases of steel and alloy fabrication for industrial uses, and for applications where appearance is of prime importance.

Electroplating Laboratory

The Hanson-Van Winkle-Munning Co., Matawan, N. J., announces the development of the Diggin Electroplating Control Table, a complete miniature plating laboratory designed for either routine control of plating solutions or the most exacting research work on electroplating problems and processes.

With this new scientific control instrument, the Control Table, it is claimed test panels can be plated under closely controlled conditions so that the results of additions, impurity removal treatments and variations in operating conditions can be observed. Only a few hundred milliliters of electrolyte are required to conduct these tests.



The electroplating control table consists of a modern laboratory table, constructed throughout of steel, with a special corrosion-resisting finish. The working surface is selected calcite-free alberene stone. The table has a large storage cabinet in which a small motor generator and battery can be installed, and two drawers for holding anodes, cells, leads, etc.

Above the working space on the right side of the table is a 36 x 36 inch control panel on which are mounted all instruments and service outlets required for electroplating tests. Four pairs of jacks are connected through selector switches to an accurate, wide-scale ammeter and voltmeter. Each circuit employs a separate shunt for increased accuracy. The current in each circuit is controlled by a stepless carbon-pile rheostat and an off-on switch. A heavy-duty P.P.D.T. switch makes it possible to connect the entire load to either generator or battery. (Battery operation is often desirable to eliminate current fluctuations or for making overnight runs.) By flipping two toggle-switches, the generator is connected to the battery for charging and the small ammeter, normally in the electro-cleaner circuit, indicates the charging rate, which in turn, is controlled by the generator field-rheostat.

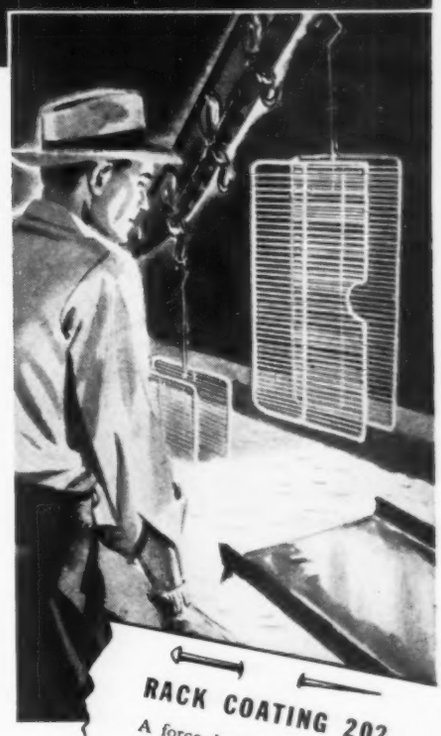
An electric timer is provided for accurate timing of tests. A red pilot light is in operation during the test; when the selected time interval has expired, a green pilot light goes into operation simultaneously with a warning buzzer.

A 110 V-A.C. convenience outlet is located at one side for operating motor-driven stirrers, electric hot plates; immersion heaters and similar accessories. Two compressed air outlets with needle valves are provided for air agitation of electrolytes or for the operation of an air-driven stirrer.

The cleaner control section of the panel consists of an ammeter, a carbon-pile rheostat, an on-off switch and a switch which shunts-out the rheostat. Leads from these controls are connected to a hinged anode-cathode rod assembly on the right side of the table top. Specimens are prepared for plating, rinsed or given special treatments after plating in glass cells. These cells, six in number, are fitted by rubber gaskets into a heavy-gauge stainless steel tray. Three of the 1500 ml. cells rest on thermostatically-controlled hot plates. These positions are used for hot electrocleaners, hot pickles and the final hot water rinse. The remaining three cells are unheated and are used for rinsing, pickling, cyanide dipping or bright dipping. A separate control panel is provided with switches, pilot light, thermostatic control knobs and a switch for the ventilating fans. The stainless steel tray is pitched toward an opening in one end where the overflow from rinses passes through a silicon-iron sink and trap. Water taps are provided for continuous flow of water in the cold and hot water rinses. The overflowing water sweeps the tray clean of drippings from the

A WHOLE YEAR OF TOUGH CLEANING CYCLES

. . . and Coating Still O K!



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The Air-drying Coating that Platers Prefer

A large metal-process plant reports that racks protected with Unichrome Coating 203 have given excellent service through an entire year of severe cleaning cycles. Service records like this show why so many plating-room foremen and superintendents prefer Coating 203 for all of their air-drying rack coating requirements.

This coating has excellent adhesion for all plating cycles such as chromium, nickel, copper, zinc, and cadmium. It's easy to apply—simply dip the rack in the convenient open-end drum and hang it up to dry. Tough and flexible, it stands plenty of rough handling and cuts cleanly at contacts. Write today for prices and data.

RACK COATING 202

A force-drying coating that provides the extra adherence necessary for the most severe cycles, such as anodizing and hot alkaline cyanide solutions.

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THE OSTRICH HAS NOTHING ON PLATERS WHO WON'T TRY BUNATOL 785

- The story of the ostrich may be fiction but it's a fact that the plater who won't try BUNATOL 785 is emulating the ostrich story by hiding from an opportunity to improve and increase production at lower cost.
- Made tough to withstand hot alkali cleaners, strong acid and alkali solutions and the hard usage and careless handling to which racks and fixtures are often subjected these days in decorative plating — Copper, Nickel and Chrome.
- BUNATOL 785 is a heavy-bodied, free-dipping liquid giving superior rack insulation with less labor cost. Only one material, one tank required.
- A generous test sample and further information await your request.

NELSON J. QUINN COMPANY, TOLEDO 7, OHIO

BUNATOL 785

various treatments. An auxiliary tap near the sink can be used as a spray rinse.

An alberene stone shelf is located to the rear of the stainless steel tray, which is useful for storing samples to be examined. Above this shelf is mounted a rail on which plated specimens can be arranged in sequence for comparative study. For drying plated panels, an air hose with an automatic nozzle and shut-off valve is mounted along the right end of the table.

Four Hull cells and four special cells for bent cathode tests with the necessary leads and jacks complete this remarkable "packaged" plating laboratory. Each plating position is normally fitted for the delivery of fifteen amperes, equivalent to 273 amperes per sq. ft. on a 1 x 4 inch bent cathode test specimen. Meter ranges can be altered to suit requirements.

Full information on the Diggin Electroplating Control Table can be obtained on request from the Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Courses in Electroplating

The Institute of Electrochemistry and Metallurgy, 59-61 East Fourth St., New York City, will offer specialized courses in the field of electroplating and metallurgy during 1946-47. Advancements made in the metal finishing field during the war years are covered. Veterans can attend the school under the G.I. Bill of Rights. Registration will be held for the Fall term from *September* 23 to *September* 27, and the first class will be held on *September* 24. The following studies will be offered:

Fall Courses

Electroplating I.

The course is designed to give the electroplater or industrial worker a foundation in chemistry including qualitative and quantitative analysis. One hour each evening will be devoted to class lectures in which will be discused the theories of modern chemistry as applied to electroplating. The remaining hours will be devoted to the laboratory where the student will conduct his own experiments. Tuesday and Wednesday from 7:30 to 11:00 P. M. Dr. Young, Mr. Klinse and Mr. Bundy. Fee, $55.00.

Metallurgy I

The student will be introduced to the structure of metals and alloys and factors are taken into account which affect these, such as temperature, mechanical working, etc. The application of the phase rule to physical metallurgy will be discussed. Both binary and tertiary systems will be studied and illustrated. Heat treating, surface treating and testing of metals and alloys will be studied. Tuesday and Wednesday, 8:30 to 9:30 P. M. Dr. Young and Mr. Klinse and Mr. Bundy. Fee, $40.00.

Research I.

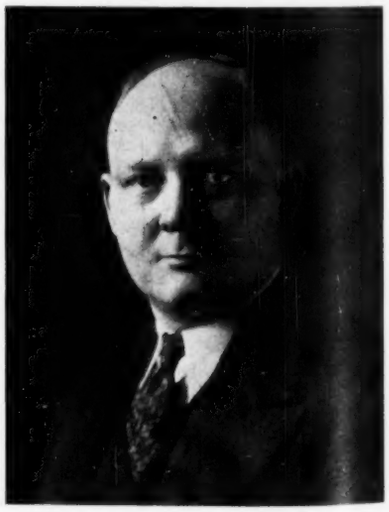
This course is designed to give the practical electrochemist a chance to investigate problems in his field. One-half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00 to 11:00 P. M. Dr. Young. Fee $40.00.

Time payments may be arranged if desired.

Business Items

WYANDOTTE NAMES CHESNUT

Charles O. Chesnut became general manager of the newly organized Pacific Division of *Wyandotte Chemicals Corp.* effective August 1st. Manufacturing and distributing activities in the Pacific States of the products of both the J. B. Ford and Michigan Alkali



Charles O. Chesnut

Divisions of Wyandotte and of *Natural Soda Products Co.*, will now be directed from the new Pacific Division office, 502-14 Central Tower Building, San Francisco 3, Calif. The Pacific Division will also solicit business on the new Wyandotte organic specialties and fine chemicals.

Mr. Chesnut also became president of Natural Soda Products Co. August 1st on the retirement of *Stanley Pedder*, who had requested more time to devote to his law practice. The manufacturing operations of this organization are at Owens Lake, California.

Field sales activities of the former J. B. Ford Division (specialized cleaning compounds) will continue to be supervised by *P. S. Spencer*. Mr. Spencer joined the company in 1924, and has served as manager in Portland, Denver, and San Francisco, becoming Pacific Coast Supervisor in 1941. Mr. Spencer will be Sales Manager of the newly organized Pacific Division and will continue to supervise the company's sales organization in the territories of Seattle, San Francisco, and Los Angeles.

Mr. Chesnut was vice president and general manager of *McCord Corp.* of Detroit before he joined Wyandotte Chemicals in 1945. Under his direction, considerable expansion is expected in the Pacific sales territory.

McCRACKEN APPOINTED TO NEW POST BY DETREX

Detrex Corporation, Detroit, Mich., has announced the appointment of *Dr. William L. McCracken*, recently discharged from the U. S. Army Engineers with the rank of lieutenant colonel, to the position of administrative assistant to *C. F. Dinley, Sr.*, vice president in charge of research and engineering.

Dr. McCracken's new duties, according to *A. O. Thalacker*, vice president and general manager, will provide both administrative and technical assistance to Mr. Dinley in research and product development in all of the company's three major divisions: industrial metal cleaning, drycleaning, and oil-extraction.

Prior to the war, he had charge of research and development for oil-extraction. He holds three degrees, B. S. (School of Mines and Metallurgy, University of Missouri), M. S. and Ph.D. (Iowa State). Dr. McCracken worked at Iowa State as a research fellow until 1939 when he first entered the Detrex organization. He is a member of the *American Chemical Society* and the *American Society of Oil Chemists*.

Dr. William L. McCracken

words of approval keep pouring in!

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THE *New* AIR-DRY RACK COATING

- MICCROTEX is a superior thermoplastic insulating material developed by experienced platers.
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- MICCROTEX effectively minimizes dragout—is easy to use—saves time and material in application.

DEVELOPED AND MANUFACTURED BY EXPERIENCED PLATERS

MICCROTEX is blazing a new trail in plating techniques — establishing new records for speedup, efficiency and economy in rack coatings. Write for detailed bulletin.

MICCRO Products

MICHIGAN CHROME AND CHEMICAL COMPANY

6340 East Jefferson Avenue • Detroit 7, Michigan

R. B. HOLMES SOUTHERN REPRESENTATIVE FOR E. REED BURNS MFG. CORP.

E. Reed Burns Manufacturing Corp., with offices at 40 Withers St., Brooklyn, N. Y., and plants in Brooklyn, N. Y. and Middlesex, N. J., announce the appointment of *Mr. Richmond B. Holmes* of Baltimore, Md., as their Maryland and southern representative.

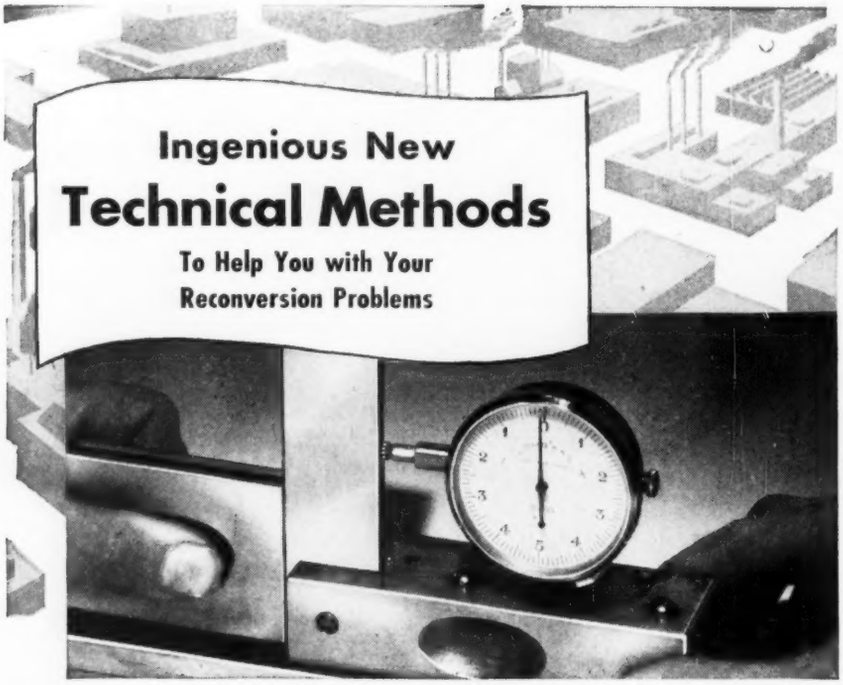
Mr. Holmes was the owner of the well known *Holmes Electroplating Works* of Baltimore, established by his father, *D. R. Holmes*. He has wide experience in the operation of a plating and polishing plant and is familiar with polishing and buffing methods.

Mr. Holmes has his office at 2001 South Road, Baltimore, Md.

MITCHELL-BRADFORD CHEMICAL CO. APPOINTS ROBERT T. SAMMET

The *Mitchell-Bradford Chemical Co.*, 2446 Main St., Stratford P.O., Bridgeport, Conn., has announced the appointment of *Robert T. Sammet* as director of research.

Mr. Sammet is a graduate of Union College, Schenectady, with special graduate training at Syracuse University, and also the Institute of Paper Chemistry at Appleton, Wisc. He was employed by *Crane & Co.*, Dalton, Mass., as a control and research chemist until the outbreak of the war. He spent three and one-half years in the Navy as a lieutenant and upon his release, the latter part of last year, became associated with Mitchell-Bradford.

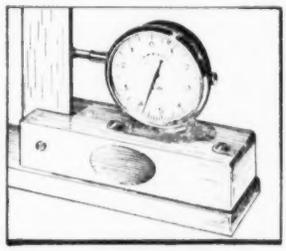


New Micro Square Instantly Checks Right Angles to One 10,000th Inch!

Ideal for precision testing, the Acro Micro-Sine Square quickly and accurately checks right angle work to 1/10,000th inch within a given distance. Its standard indicator dial instantly registers error, location of error, and amount of correction required. Designed for tool and die shops, machine shops and testing laboratories, it also provides a standard for checking master squares, tri-squares and tools.

The Acro Micro-Sine Square is very simple to operate, saves hours of time. Made of hardened tool steel, in ground and lapped precision construction. Available in two types: (1) Standard precision gauge in tenths, (2) Lever indicator in thousandths. Both complete with master checking blocks and carrying cases.

On precision jobs, requiring a static position and mental alertness, workers undergo nervous tension which often results in fatigue. Tests have shown that the act of chewing helps relieve tension—helps workers stay alert, thus increasing their efficiency to do more accurate work. For this reason, many plant owners urge workers to chew Wrigley's Spearmint Gum on this type of job.



Standard Indicator Dial

You can get complete information from Acro Tool and Die Works 4554 Broadway, Chicago 40, Illinois

AA-88

Mr. Sammet will assume the duties of supervising the development of new products and further improvement in the standard Mitchell-Bradford lines.

PENNSALT ACQUIRES FLUORSPAR MINE

The *Pennsylvania Salt Manufacturing Co.* recently announced it has purchased the *Kentucky Babb* fluorspar mine near Salem, Ky.

The mine and surface inventory were purchased from *Roberts and Frazer*, active in other fluorspar mining operations as the *Kentucky Fluorspar Co.* Pennsalt recently has completed underground explorations of the Kentucky Babb mine but is not now producing from it.

Pennsalt, one of the largest wartime producers of hydrofluoric and anhydrous hydrofluoric acid, recently announced it is making elemental fluorine available commercially for the first time. The element is being sold only for experimental purposes at present.

REYNOLDS APPOINTS W. DOUGLAS PETERS

W. Douglas Peters has been named assistant general sales manager, Foil Division, *Reynolds Metals Co.*, Richmond, Va., in charge of product sales, it is announced by George E. Egger, vice president and foil division sales manager. His headquarters will be in Richmond.

Mr. Peters has been with Reynolds in various capacities since 1934 except for a two year period in the U. S. Navy, from which he retired as a lieutenant. While in the Navy he was a specialist in the air-arm in charge of preservation of Navy craft curtailments, accessory material and spare parts.

W. Douglas Peters

For two years after joining Reynolds he was engaged in production. In 1936 he was transferred to the sales division as a sales correspondent in the Reynolds Chicago office. In 1939, after six months in Richmond, he returned to Chicago as assistant division sales manager. In 1941 he was in charge of war packaging development in Chicago for Reynolds and in 1942 went to Richmond as manager of food and medical packaging for the company. Upon leaving the Navy he returned to the company as assistant general product manager in which capacity he was serving at the time of his latest promotion.

Mr. Peters is a native of Georgetown, Ky., and is a graduate of Georgetown College.

ADDITIONS TO H-VW-M SALES FORCE

The *Hanson-Van Winkle-Munning Co.*

Wilfred G. Cryderman

Howard L. Wright

Matawan, N. J., announces the appointment of two new sales representatives, *Wilfred G. Cryderman*, and *Howard L. Wright*.

Mr. Cryderman is a graduate of Michigan State College with the degree of Bachelor of Science in Mechanical Engineering. His previous business connection was with the Cleveland office of *Westinghouse Electric Corp.* Following a training course at Matawan, he has been assigned to the Dayton, Ohio office of the H-VW-M Co.

Howard L. Wright who was recently discharged from the U.S. Navy, in which he served as a Lieutenant, has also taken an intensive field training course at the main office and plant of the Company in Matawan, N. J. He is a graduate of Franklin and Marshall College and holds the degree of Bachelor of Science in Economics, having specialized in sales and marketing. Mr. Wright has been assigned to the Philadelphia office of the Company.

HOVEY NEW HARSHAW VICE-PRESIDENT

Mr. Waldo C. Hovey has been elected vice

Waldo Hovey

An IMPROVED Burnishing Compound

A research man at Wyandotte Chemicals Corporation uses the Comparoscope to evaluate and compare the finishes on metal surfaces. By means of this carefully designed optical instrument, Wyandotte was able to make the burnishing-compound improvements that resulted in Wyandotte Burnishing Compound 315.

THIS new development in burnishing compounds is free of annoying and hazardous cyanide. Yet it surpasses the old-fashioned cyanide treatment in removing tarnish from copper base alloys, brass, bronze and copper. It gives the finest and brightest of finishes.

Wyandotte Burnishing Compound 315 rinses freely from the work and burnishing balls. It leaves no objectionable soap films to dull the work—no hard-water scum to call for frequent cleaning.

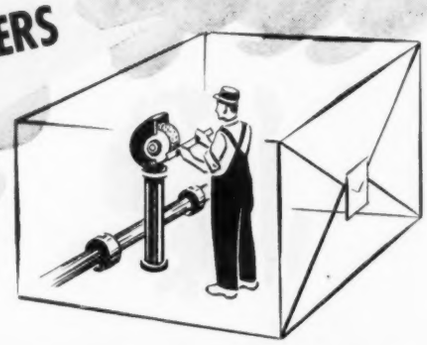
Your Wyandotte Representative will be glad to show you what lustrous surfaces you get by using Wyandotte Burnishing Compound 315. Why not give him a call today?

Wyandotte
REG. U. S. PAT. OFF.

WYANDOTTE CHEMICALS CORPORATION • J. B. Ford Division
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

HUMIDITY PROBLEM

for POLISHERS



AT LAST! You Can Keep Production in High Gear Regardless of the Weather with GRIPMASTER

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POLISHING WHEEL CEMENT

Extensive tests by users and in our own laboratories prove: When Gripmaster is used 40 minutes at 150° F. it dries the wheel head completely . . . makes it *impervious* to moisture! Gripmaster retains its adhesive properties even in the most humid room. Discover this important new benefit for yourself. Send for generous free sample today!

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Please send us a generous free sample of Gripmaster, fortified against humidity.

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Simple test sets for controlling these and other solutions available.

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CHICAGO 32

Specify Kocour Sets from your supplier.

president in charge of Research and Development of *The Harshaw Chemical Co.* according to an announcement by president *W. J. Harshaw*. He is assuming his new duties at once.

Mr. Hovey graduated from McGill University in 1916 in Chemical Engineering. From 1916-1925 he was connected with *Shawinigan Chemicals Corp.* as superintendent. From 1925 to 1944 he was with *Niacet Chemicals Corp.*, Niagara Falls, N. Y., as general manager. From 1944-1946 he was manager of plant operations with *Wyeth, Inc.*, Philadelphia.

PEMCO APPOINTS MAJOR THOMAS TO STAFF

The *Pemco Corp.* announces the appointment of *Major Henry H. Thomas* to its research and development staff. Major Thomas graduated in 1941 from North Carolina State University with a B.S. in Ceramic Engineering. Immediately following graduation he volunteered for and was accepted by the United States Army Ordnance Corps. He

Major Henry H. Thomas

received his initial training in California and remained there until he was ordered overseas as the Divisional Ordnance Officer of the 88th Division.

During the 23 months which Major Thomas spent overseas he visited many of the foreign pottery manufacturers throughout Italy, England, and Sweden and gained much valuable information which will aid him in his work. Major Thomas was honorably discharged from the Army on March 8, of this year.

MATHIESON ENTERS NEW FIELD

The Mathieson Alkali Works, Inc., has entered the fire protectiion field with both high and low pressure carbon dioxide equipment, it is announced by *George W. Dolan*, president of the company. Producer of heavy chemicals and chemical specialties, the company operates one of the largest carbon dioxide plants in the world at Saltville, Va.

Chas. T. Longaker, manager of Mathieson's carbon dioxide division, has named *Harry Ensminger* to head the fire protection depart-

ment, with headquarters at the company's New York offices.

Specializing in built-in systems, Mathieson is the only company offering both high and low pressure systems. Engineering service includes surveys of occupancies to determine fire protection requirements, plans for systems and supervision of installation.

For large users, recharging problems will be simplified by the company's recently announced dry ice liquefier which has a capacity of 1,000 lbs. of carbon dioxide. For others, recharging facilities are available at 16 distribution centers.

NEW APPOINTMENTS LISTED BY PENNSALT

Frederick C. Abbott, formerly manager of the New Products Division, has been named assistant production manager in the Manufacturing Department of the *Pennsylvania Salt Manufacturing Co.*, it was announced recently. He reports to *C. S. Beldin*, production manager.

Hugh Richard Bishop, recently released as a lieutenant colonel in the air forces after four years of service, has been named manager of the New Products Division replacing Mr. Abbott. *Martin E. Johnson* has been transferred from the Market Research Department to the New Products Division.

Mr. Abbott, a graduate in chemical engineering from the University of Arkansas, came to the company from the *Phosphate Mining Co.* in 1943 and previously was connected with the *Ozark Chemical Co.* and the *Texaco Salt Co.* He was in the Market Research Department of Pennsalt before becoming manager of the New Products Division. He is a member of the *American Chemical Society*, the *American Institute of Chemical Engineers* and *Franklin Institute* of Philadelphia.

Mr. Bishop graduated from Lehigh University and coached wrestling and taught physical education at the University of Pennsylvania before joining the company in 1939. He is a member of the *Mining and Metallurgical Society* and *Phi Gamma Delta*. He entered the Army in 1942. Mr. Johnson, formerly with *Rohm and Haas*, joined the Market Research Department in 1945.

NEW NAME FOR MICHIGAN BLEACH

The *Michigan Bleach and Chemical Co.*, 12345 Schaefer Highway, Detroit 27, Mich., advise that effective immediately, their company will operate under the name of *Nelson Chemicals Corp.* It is stated this will lead to smoother inter-organization operations in the proposed expansion program.

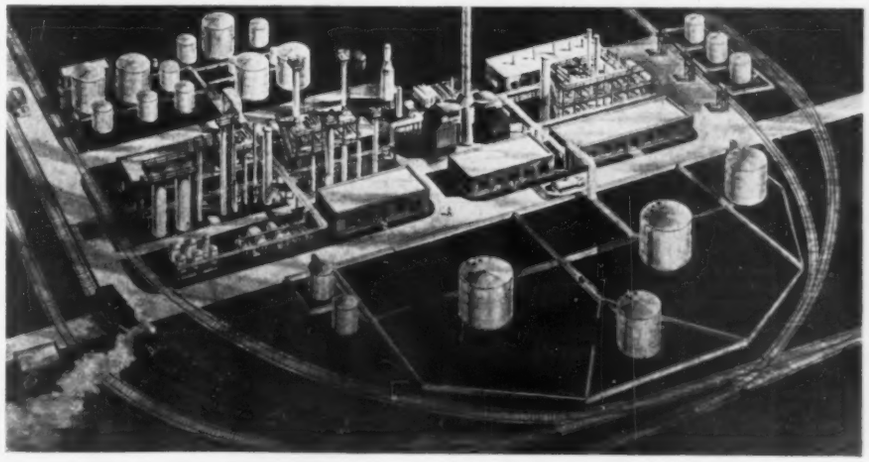
The change affects the Cleveland, Ohio and Windsor, Ontario affiliates of this company and is expected to facilitate service to customers, both here and in Canada. Polishing wheel cements, glues, bleaches and various chemicals are manufactured by the company and its affiliates.

WYANDOTTE TO EXPAND

$25,000,000 will be spent by *Wyandotte Chemicals Corp.* in additions and enlargements to its present plants within the next eighteen months, it was announced recently by *E. M. Ford*, president.

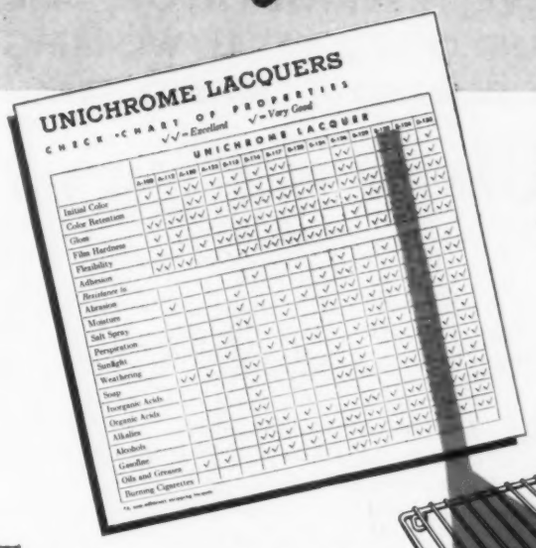
The improvements will make Wyandotte, already one of the world's largest manufacturers of industrial inorganic chemicals and specialized cleaning materials, an important factor in the organic field.

One phase of Wyandotte's expansion in the organic field will be the erection of the new synthetic detergent plant. Synthetic de-



Part of Wyandotte Chemicals $25,000,000 Expansion Program

TAKE THE "GUESSWORK" OUT OF LACQUER SELECTION



Accurate Check Chart Shows You the ONE Lacquer that's RIGHT for the Job

THERE's only *one* sound basis on which to select the *right* lacquer for a particular job—one that will mean competitive survival for your product. And that's by selecting the lacquer with properties best suited to withstand conditions your product will meet in service. This simple check chart enables you to do just that—quickly and easily.

All values are conservative . . . based on severe laboratory tests. From the 14 Unichrome lacquers, each with a different combination of properties, you can pick the "right" finish for even the special jobs.

For complete information—write today to your nearest United Chromium office.

CONSIDER THIS REFRIGERATOR SHELF, made of zinc-coated steel with a protective, corrosion-resistant, Anozinc treatment. Manufacturer's specifications called for a finishing lacquer, which needed high gloss, adhesion, and resistance to moisture, perspiration, soap, organic and inorganic acids, alkalies, and abrasion. The check chart showed that for a clear lacquer, B-132 had the best combination of these properties.

UNICHROME

PROCESSES AND MATERIALS FOR SURFACES THAT SURVIVE

Chromium Plating · Porous Chromium · Unichrome* Copper · Unichrome Lacquers · Ucilon* Protective Coatings · Unichrome Stop-Off Lacquers and Compounds · Unichrome Dips · Unichrome Rack Coatings · Anozinc* Compounds · Unichrome Strip

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ANNOUNCEMENT

TO AUTOMOTIVE, REFRIGERATOR, AIR CONDITIONING AND OTHER METAL WORKING INDUSTRIES THAT DEMAND A QUALITY FINISH

The AMERICAN CHEMICAL PAINT COMPANY

is back in the Rust-Proofing Business---TO STAY!

Since 1914 ACP has pioneered in rust prevention and other metal working chemical problems. DEOXIDINE—the original phosphoric acid metal cleaner and rust removing conditioner has been credited with saving the then infant automobile industry, by making possible a durable paint finish on steel bodies.

Today the manufacturer who demands quality and durability may further improve his product by the use of phosphate bonding coatings to protect both the lustrous paint finish and the metal as well. Many of the most effective and economical phosphate coating processes—so widely used in industry today —were developed in the ACP laboratories. In 1940, however, circumstances forced ACP out of the phosphate coating field.

ACP is now in position to exploit and develop further its patented ACP COLD SPRAY-GRANODINE (peroxide-zinc phosphate) coating process. Already many of our former customers have readopted it, and more are planning to change in the near future to get the savings of this low temperature process that produces a hard zinc phosphate bonding coating on which the highest paint luster can be obtained. It protects the lustrous beauty of the paint finish — and the metal as well. A GRANODIZED product gives assurance of the quality of the paint finish.

Another ACP product — THERMOIL-GRANODINE — is again available to produce wear resistant phosphate coatings on friction bearing surfaces

Quality products that are "GRANODIZED" with ACP COLD SPRAY GRANODINE; "DURIDIZED" with ACP DURIDINE 210B; or "CROMODIZED" with ACP CROMODINE are *Certified for Rust Resistance.*

AMERICAN CHEMICAL PAINT COMPANY

CHEMICALS ACP PROCESSES

AMBLER, PENNA.

CHEMICALS ACP PROCESSES

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New Improved

LUSTREBRIGHT

Bright Nickel Process

Produces Brilliant, Lustrous Nickel Deposits.
Eliminates Color Buffing—Re-Cleaning—Re-Racking.
An Ideal Base for Chromium. Excellent Throwing Power.
No Special Solutions or Changes in Equipment Required.
Easy to Control—Low in Cost—Successful—Practical.

Uniform results obtained on all classes of work in still tanks or mechanical barrels. Excellent for zinc die-castings. Any cold nickel solution of standard formula will with the addition of NEW IMPROVED LUSTREBRIGHT give brilliant, lustrous, adherent deposits. Guaranteed not to harm plating solution. Will not cause plate to peel, become brittle or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of NEW IMPROVED LUSTREBRIGHT. Write for complete information.

W. C. BRATE COMPANY

14 MARKET ST. *Est. 1860* ALBANY, NEW YORK

tergents, or soapless cleaners, are used both alone and as components of specialized cleaning compounds. Another organic unit representing an investment of several millions of dollars, and already under construction, will supply materials to the commercial chemical field.

In addition to the installation of these facilities for production of new products by Wyandotte, there will be new plants erected to increase production of chlorine, calcium carbonate and soda ash.

Improvements in the present method of producing caustic soda will also be a feature of the expansion program and will increase the output of this chemical which is an essential ingredient in products used for metal cleaning processes.

Vitally important to the expansion program will be the installation of new facilities which will approximately double the present steam and power production.

Expansion of staff is proceeding hand in hand with plant enlargement. Important additions to personal have been made in the *J. B. Ford Division* headed by vice-president *C. B. Robinson*, and the *Michigan Alkali Division* under vice-president *Bert Cremers*. Technical Service, the department concerned with customer guidance in the use of industrial chemicals, has been expanded. Research and Development staffs, as well as the Engineering Department, have also been increased.

Significantly, the hundreds of thousands of tons of industrial chemicals which will be added to world markets will serve as raw materials for the production of a wide variety of new and improved products.

HEIL CHANGES NAME

It is announced that the manufacturing business of *Heil Engineering Co.*, 12901 Elmwood Ave., Cleveland 11, O., has been incorporated as *Heil Process Equipment Corp.* The new corporation will continue in the heat exchanger and similar products business, and will maintain the same personnel and ownership at the above address.

LAMBROS PRECIOUS METALS CORP. FORMED

George C. Lambros and *Precimet Laboratories* announce their consolidation into *Lambros Precious Metals Corp.*, 64 Fulton St., New York 7, N. Y. The new firm will continue as refiners and dealers in precious metals and are noted for their palladium and gold plating baths.

NEW PLATING SUPERINTENDENT AT ACME

The *Acme Electroplating Co.*, 1810 West North Ave., Chicago, Ill., has added *Mr. John Kurdenak* to its staff as plating superintendent.

J. D. HAMACHER DETREX PLANT ENGINEER

A. O. Thalacker, vice president and general manager of *Detrex Corp.*, Detroit 32, Mich., has recently announced the appointment of *J. D. Hamacher* as plant engineer.

Mr. Hamacher is a graduate of the Uni-

Distributors!
Don't Overlook—

Michigan
ABRASIVE COATED BELTS

It's not new to you that an ever-increasing number of Abrasive Belts are being employed by manufacturers in preparation of metals for plating. With that thought in mind the Michigan Abrasive Company is making it possible for Polishing and Plating supply distributors to obtain belts adapted especially to the requirements of the trade—and which will show the distributor a substantial profit.

Michigan belts are available in any width, length and standard grit size.

Send for our Distributor proposition.

Michigan Abrasive Co.

Manufacturers of

COATED ABRASIVES and LAPPING COMPOUNDS

1111 Bellevue Street • Detroit 7, Michigan

versity of Detroit and since joining Detrex, early in 1944, has been employed as design engineer in the oil-extraction division. His new duties include plant layout and supervision of maintenance of all company's properties and buildings.

Manufacturers' Literature

Publications listed in this department are obtainable from the manufacturer without charge.

Abrasive Belt Grinders

An 8-page booklet portraying various belt grinders manufactured by the *Hammond Machinery Builders, Inc.*, has just been released.

Three new belt grinders are illustrated and their features explained in detail. One, a floor model belt grinder, can be used either wet or dry and is equipped with coolant unit consisting of tank, spray nozzle, valve and piping, and pump with independent motor, according to the booklet. It is claimed that this type machine is ideal for flat surface grinding and polishing of castings, die castings, forgings, plastics, etc., and for grinding, polishing and deburring sheet metal parts. The unit is arranged for connection to city water main with drain to sewer.

Another model, floor type but of lighter construction than the first, is claimed to do faster and better grinding, polishing, buffing, deburring and other similar operations. It is equipped with either a left or right hand backstand, or both.

The third belt grinder illustrated is a lightweight bench type machine and is stated to be one of the most versatile units in use for irregular contour grinding and polishing. Five sketches of irregular shape application are also given.

The booklet may be had by writing to Hammond Machinery Builders, Inc., Dept. MF, Kalamazoo 54, Mich., and asking for *Bulletin* 310.

Metal Cleaner Application

A new booklet issued by Apothecaries Hall Co., is designed to show how their Ahcoloid metal cleaners are applied to many industrial cleaning operations. An informative discussion of metal cleaner functions and methods precedes each description of the company's material.

Under "Cleaners for Soak Tanks," several types are given, and it is claimed all have a specific function as soak cleaners of steel and various alloys. Especially do they recommend their heavy duty general purpose soak tank material.

For electrocleaning, special types of Ahcoloid cleaners are recommended for following soak treatment, for zinc and zinc base die castings, when insufficient current can be had, and a general purpose cleaner for steel and most non-ferrous metals.

The cleaners for barrel and burnishing are listed as either highly alkaline for both cleaning and burnishing steel, for barrel burnishing and cleaning non-ferrous metals, and a general purpose barrel cleaning material.

Copies are available by writing to Apothecaries Hall Co., Dept. MF, Waterbury 88, Conn.

Corrosion-Resistant Alloy

A new bulletin of interest to process operators and engineers who handle corrosives is available from *The Duriron Co., Inc.*, Dept. MF, Dayton 1, Ohio. It lists application of high-silicon cast-iron alloys as used in industry for commonly used acids, methods of installation, and explains how to avoid misapplication. By the manufacturer's claims, it states that both *Duriron* and *Durichlor* are especially resistant to all acids except hydrofluoric, fuming sulfuric and sulfurous.

The folder gives pipe and split flange limitations in the handling of corrosives, and integral flanged pipe advantages. It lists available pipe, elbows, fittings, hose connections and couplings, and explains methods of welding Duriron pipe. It also tells of special corrosion resistant items manufactured by the company.

The pamphlet may be secured by asking for *Bulletin No.* 704 at the address mentioned above.

New pH Meter Explained

Bulletin No. 2 of the *Macbeth Corp.* contains explanatory material about the new pH meter manufactured by that company. It has clear detailed photographs of the new instrument and contains pertinent data on operation range.

It is claimed the meter is line operated, continuous indicating, direct reading, and that in continuous operation, it drifts only .1 to .2 pH in twenty-four hours. An index pointer is made part of the instrument so that any shift can be detected and reference made to the buffer solution, thus making an automatic adjustment check, according to the folder. It also explains composition

CHROMIC ACID

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines, Mutual is the world's foremost manufacturer of Chromic Acid.

MUTUAL CHEMICAL CO. OF AMERICA — OVER A CENTURY OF CHROMIUM CHEMICAL PROGRESS

Bichromate of Soda
Bichromate of Potash

MUTUAL CHEMICAL COMPANY OF AMERICA
270 MADISON AVENUE NEW YORK 16, N.Y.

PLATING RACKS
by JOSEPH NOVITSKY

- We specialize in plating racks of our own patent.
- Constructed without screws, rivets, solder, brazing, welding.
- We design racks to suit your individual problem.

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Factory: 147-24 Liberty Ave., Jamaica 4, L. I., N. Y.
(Phone—REpublic 9-7223)

of the glass electrodes and their limitations.

The bulletin may be had by writing to the Macbeth Corp., Dept. MF, 227 W. 17th St., New York 11, N. Y.

Pickle Pills

Quick, Accurate Pickling Tank Tests is the title of a folder recently issued by *Ferro Enamel Corp.*, Dept. MF, 4150 E. 56th St., Cleveland, O. The folder describes an "on the spot" check available for determining the strength of pickling tanks and iron content of tanks. The spot check is in the form of pickle pills, patented and manufactured by the company.

Copies of this folder are available without obligation from the company.

Plastic Eye Masks

A folder describing its lightweight safety eye mask is available by the *Standard Safety Equipment Co.*, Dept. MF, 232 W. Ontario St., Chicago 10, Ill. The manufacturer lists six points in which the product, it claims, covers industrial eye protection completely.

Photographs illustrate the injection-molded plastic lenses and pliable plastic head band, and according to the manufacturer, has withstood the most rigorous tests for this type of safety equipment.

Rotary Blowers

Roots-Connersville Blower Corp., Dept. MF, Connersville, Ind., has issued Bulletin 22;23-B-12 covering Rotary Positive Blowers, containing 24 pages, including the cover.

In addition to numerous installation illustrations, there are characteristic curves, cross-sections, and exploded views to show the operating principle and construction features. Relief valves and other accessories are illustrated and described, and there is a page of detailed specifications, and a table of standard sizes covering gear diameters from 8 to 22 inches.

Corrosion Control

A new 13-page well illustrated booklet dealing with the use of magnesium anodes for cathodic protection has just been published by the *Magnesium Division* of *The Dow Chemical Co.*, Midland, Mich. Descriptive information regarding this method of corrosion control is presented along with answers to some of the more commonly asked questions concerning this subject.

Copies of the booklet may be secured without charge by writing to Magnesium Division, The Dow Chemical Co., Dept. MF, Midland, Mich.

New Model Purity Meter

A bulletin illustrating the new Purity Meter and showing through a series of drawings its method of operation has been issued by *Barnstead Still & Sterilizer Co., Inc., Dept. MF*, Lanesville Terrace, Forest Hills, Boston 31, Mass. This instrument tests the purity of distilled or demineralized water by measuring the tiny current conducted by ionizable impurities in the water. The result is read on a scale calibrated from 0 to 15 p.p.m. total impuri-

ties expressed as NaCl. An electric eye gives quick, positive indication of correct setting. A new conversion table of metal is attached to the meter which gives equivalent readings in ohms (resistance) and micro-ohms (conductance). Complete specifications and a list of accessories are included. Copies of this bulletin, No. 113, are available upon request.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

CHICAGO BRANCH

The regular monthly meeting of the Chicago Branch of *A. E. S.* was held on Friday, July 12th at the Atlantic Hotel. Instead of the usual procedure of having a speaker and discussion, the report of the delegates from the Branch on the proceedings at the Pittsburgh Convention was had. *Mr. J. W. Hanlon* covered the business meeting of the *Supreme Society*. *Mr. Marion Longfield* gave a brief discussion of the technical papers presented.

Mr. Frank Savage of *Kuehne Mfg. Co.*, Mattoon, Ill., the Supreme President of the National Society, gave an excellent discussion of the financial picture of the Society and outlined the budget for the coming year. In connection with the Review, the fact that the editorial matter was 30% greater during the past year than at any previous time was stressed by Mr. Savage. He also discussed the Research Program at considerable length, covering the work done by the project directors at the various colleges and universities which the Research Committee had chosen for placement of the problems, and also stressed strongly the fact that this type of undertaking had never before been attempted on such a scale by any technical society in the world. He indicated that to keep this type of endeavor alive, serious cooperation must be forthcoming from every branch and every member.

Mr. Owen Towner, Chairman of the Membership Committee impressed upon the

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SPEEDS UP REMOVAL OF NICKEL DEPOSITS

Simply add STRIPODE to your regular Sulphuric Acid strip bath and watch it speed up! Removal of nickel is more complete in less time, with less acid. You get a better job and save besides.

PROTECTS THE BASE METAL - - SAVES BUFFING

The protection which STRIPODE gives to the base metal helps prevent pitting and roughening. Users report marked savings by elimination of polishing and severe buffing operations.

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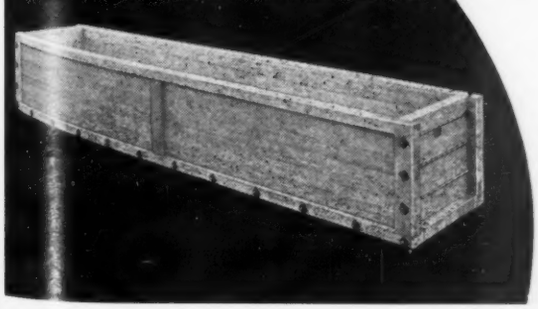
Please send me full information and free sample of STRIPODE for better nickel stripping.
Name .....
Address .....

Metal Finishing, September

Wood Tanks for Plating and Pickling



Excellent service on all types of Wood Tanks.

The shortage of metals has increased the demand for wood tanks for plating and pickling service. We can give excellent service on all types of tanks. Send us your inquiries.

Kalamazoo TANK & SILO CO.
KALAMAZOO - MICHIGAN

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Quality and Uniformity at All Times

STAINLESS STEEL POLISHING COMPOUNDS

for Cutting—Cut and Color—Mirror Finish
FASTER CUTTING—INCREASED PRODUCTION

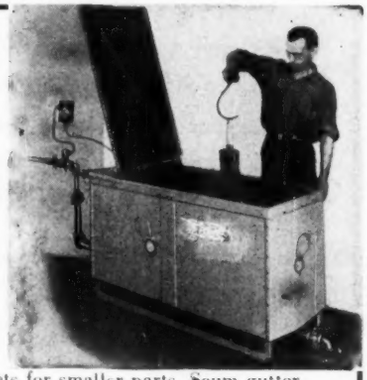
There's a Harrison Compound for your special problem. Write us. We'll gladly send samples.

NEW COMPOUND for either SPRAYING or DIPPING

HARRISON & COMPANY, INC.
HAVERHILL, MASSACHUSETTS
Polishing Compounds - - - 4-A Cement

Cleaning Metal Surfaces in the HEETMASTER HOT DIP TANK *with*

PERMAG



Cleans and degreases small metal parts as well as larger metal surfaces at a saving of 50 per cent in fuel. Heats quickly, works more economically.

These tanks are equipped with dipping baskets for smaller parts. Scum gutter runs length of tank and sludge drain scrapes and draws off refuse.

Made in sizes to meet your requirements.

HEETMASTER Hot Dip Tanks are sold by MAGNUSON PRODUCTS CORPORATION. Write for details. Interviewing our technical men involves no obligation on your part.

Magnuson Products Corporation
Manufacturers Specialized Cleaning Compounds for Industry
50 COURT STREET BROOKLYN 2, N. Y.
In Canada: Canadian PERMAG Products Ltd., Montreal, P. Q.

Branch the fact that the membership must be increased by at least 50% during the ensuing year.

For the second straight meeting, there were no questions in the question box. The Chair commented that the calibre of the members must be high indeed, since no one was requesting information.

AMERICAN SOCIETY OF TOOL ENGINEERS

PITTSBURGH NATIONAL CONVENTION

The *American Society of Tool Engineers* announced today, through its President, *A. M. Sargent*, preliminary plans for the largest Semi-Annual National Convention in the Society's history to be held at Pittsburgh, Pa., October 10-11-12, 1946. Convention headquarters will be the Hotel William Penn where the entire 17th floor has been reserved for scheduled activities.

Seminars on timely technical subjects, visits to industrial plants in the Pittsburgh area employing new production techniques, showings of engineering films, the Semi-Annual Banquet, and many special events make up the comprehensive convention agenda, according to Sargent.

THE AMERICAN SOCIETY FOR METALS

DR. RUFUS E. ZIMMERMAN AWARDED MEDAL

The *American Society for Metals* has announced that *Dr. Rufus E. Zimmerman* has been elected to receive the *Society's Medal for the Advancement of Research for* 1946. Dr. Zimmerman is vice president in charge of Research and Technology of the *United States Steel Corp. of Delaware*. His offices are in New York and Pittsburgh.

Qualifications of the candidate for receipt of this medal do not specify that any one research achievement shall be the basis for the award. Rather, the qualifications state that "the candidate shall be an executive in an industrial organization the principal activity of which is the production or the fabrication of metals. He shall be one who,

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SHEETS AND COILS

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Established 1898 PERU, ILLINOIS

CHROMIUM PLATING
SCREWS-RIVETS-WASHERS
SMALL PARTS, ETC.

THE CHROMIUM PROCESS CO.
Shelton, Conn.

over a period of years, has consistently sponsored metallurgical research or development and by his foresight and his influence in making available financial support has helped substantially to advance the arts and sciences relating to metals."

The medal was first awarded in 1943 to *Roy A. Hunt*, president of the *Aluminum Co. of America*. It was won in 1944 by *Robert C. Stanley*, president of the *International Nickel Co.* and in 1945 went to *Gerard Swope* of the *General Electric Co.*

Award of the medal, plaque and citation will be made at the annual banquet of the American Society for Metals to be held in Atlantic City, N. J., on November 21st during the *National Metal Congress and Exposition*.

Dr. Zimmerman was born at Mt. Pleasant, Pa. He was graduated from Franklin and Marshall College with the degree of Ph.B., and received the degree of D.Sc., from the same institution in 1938. He holds the degree of S.B. from the Massachusetts Institute of Technology and L.L.D. from Thiel College.

Dr. Zimmerman is a director and member of the executive committee of the *United States Steel Corp.* of Delaware; member of the *Corporation of M.I.T.*, trustee of Hood College and Franklin and Marshall College; president of the *American Standards Association*; member of the Metallurgical Advisory Board of the *Carnegie Institute of Technology*; director of the *Air Hygiene Institute*; member of the Engineering Advisory Council of Princeton University and was a consulting chemical engineer of the *United States Bureau of Mines* during the war.

NATIONAL METAL CONGRESS AND EXPOSITION

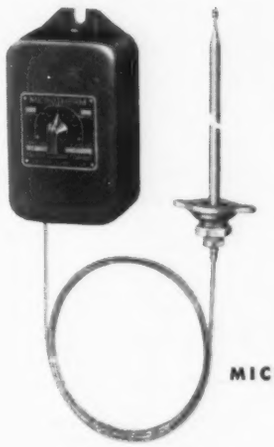
As of July 1st, 86% of the exhibit space for the 28th annual *National Metal Congress and Exposition* had been sold. Specific areas have been assigned to 275 exhibitors for the five day event which will be held in *Atlantic City's Municipal Auditorium* beginning November 18th.

W. H. Eisenman, managing director of the NMCE, explained that floor plans had previously been sent only to former exhibitors in the show. Because of current interest among non-exhibitors (in preceding NMCE shows) floor plans are now being sent to them. With space reservations moving faster than for any preceding show, it is anticipated that the entire available space will be quickly reserved.

Advance programs of the participating societies reveal that unusual interest is being displayed by authors of technical papers. Already, the program committee of the American Society for Metals reports that more than twice the normal number of papers have been submitted by members for consideration and possible presentation before the ASM sessions during the NMCE. *The American Welding Society*, the *Iron and Steel Division* and the *Institute of Metals Division* of the *A.I.M.M.E.*, and the *American Industrial Radium and X-Ray Society*, also participating in the Metal Show, report unusual activity in the same field in preparation for the Atlantic City meetings.

NMCE exhibit space will be utilized to

BARBER-COLMAN



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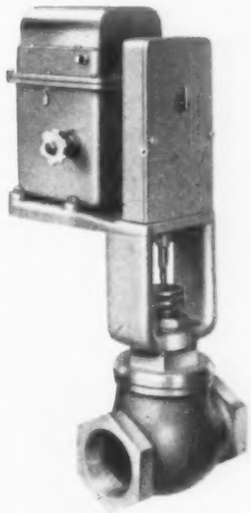
MICROTHERM

By using a solenoid-loaded contact tongue, with the pull of the solenoid governed by a rheostat on the valve motor shaft, the Microtherm is able to position the Proportioning Valve so as to satisfy exactly any change in demand. Features include simple construction, no relays, and maximum power at all points of valve stroke. "Hunting" is eliminated and the valve is positioned quickly with "micrometer accuracy." Write for Bulletin "CONTROLS FOR INDUSTRY."



PROPORTIONING VALVE

BARBER-COLMAN COMPANY
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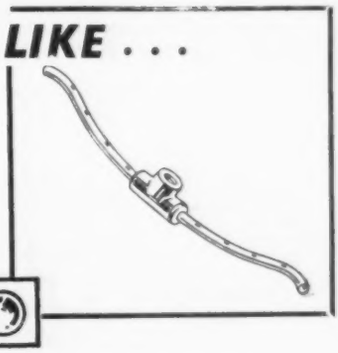
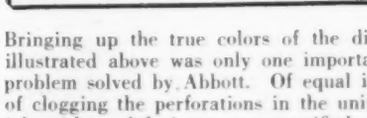
TO BURNISH A SHAPE LIKE . . .
SPECIFY
ABBOTT
MATERIALS





Bringing up the true colors of the different metals of the unit illustrated above was only one important part of this burnishing problem solved by Abbott. Of equal importance was elimination of clogging the perforations in the unit. Abbott materials did the job, without defacing . . . as specified.

Write for a sample burnishing kit.

Abbott's qualified engineers are maintained for problem solution.

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show many advancements in production and manufacturing techniques evolved during the past five years. Due to wartime security regulations, most new methods necessarily remained classified. Now, however, with the lifting of Army and Navy restraints, many of the new methods will be revealed for the first time.

COMING EVENTS OF THE SOCIETY

The National Metal Exposition
November 18-22, 1946
Municipal Auditorium
Atlantic City, N. J.
Chester L. Wells, Asst. Managing Director, 7301 Euclid Avenue, Cleveland 3, Ohio.

Annual Meeting
November 18-22, 1946
Atlantic City, N. J.
W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland 3, Ohio.

The Iron and Steel Division and The Institute of Metals Division American Institute of Mining and Metallurgical Engineers,

Annual Fall Meeting
November 18-22, 1946
Atlantic City, N. J.
Ernest Kirkendall, secretary, 29 West 39th St., New York 18, N. Y.

The American Welding Society,

Annual Meeting
November 18-22, 1946
Atlantic City, N. J.
M. M. Kelly, secretary, 33 West 39th St., New York 18, N. Y.

The American Industrial Radium and X-Ray Society,

Annual Meeting
November 19-22, 1946
Atlantic City, N. J.
Philip D. Johnson, secretary, 53 West Jackson Blvd., Chicago 4, Ill.

Obituary

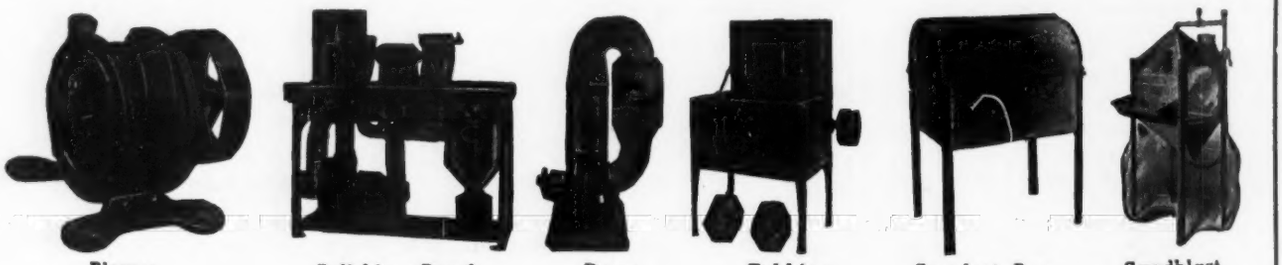
William J. Coane

William J. Coane, after a long illness, died on Wednesday, July 31. He would have been 79 years old in August. Up to the time of his recent retirement he was for 33 years Vice President of *The Ajax Metal Co.*, Philadelphia, and at the time of his death still held the office of Vice-President of the *C. Howard Hunt Pen Co.*, Camden, N.

At the recent annual meeting of the American Foundrymen's Association he was elected to Honorary Life Membership in the Association because of his long service to the industry and in recognition of the fact that although one of the few living men who attended the first convention of AFA at Philadelphia in 1896, he has remained continuously active in the industry, a period of more than 50 years. He was active in the Philadelphia Foundrymen's Association, a local group of foundrymen whose efforts led to the success of the organization meeting of the AFA.

Mr. Coane was born in Philadelphia, attended Friends School in that city, and finished his education at Central High School. He began the active labors of his career when he became associated with the *Joseph Dixon Crucible Co.*, Jersey City, N. J., and served as manager of the Company's Philadelphia division for 26 years. His contributions to business and community life were always outstanding, winning for him wide admiration and confidence. For 15 years Mr. Coane was a member of the executive Committee of the Non-Ferrous Ingot Metal Institute, Chicago, and for many years represented that organization in the capacity of National Councillor in the Chamber of Commerce of U. S.

Mr. Coane is survived by his wife, a son, G. Lynn Coane, and four grandchildren.



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Tanks, Coloring Rooms, Dynamos, Sawdust Boxes

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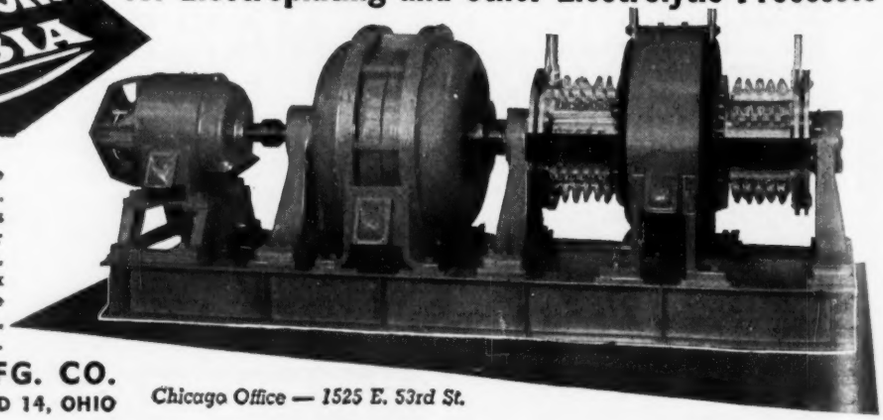
MOTOR GENERATORS by COLUMBIA
for Electroplating and other Electrolytic Processes



Columbia Generators embody every feature essential for dependable, 24-hour operation. They are built for electroplating service in sizes of 6 to 20 volts, 500 to 20,000 amperes, for anodic treatment of aluminum in sizes of 40, 50, and 60 volts, 500 to 3,000 amperes. Columbia Generators for other electrolytic processes range from ½ to 250 KW, 100 to 40,000 amperes, 6 to 60 volts. Write for full information.

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GRANIUM "A" for Platinum & Gold
GRANIUM "B" Cyanide for Electro-Platers
GRANIUM "C" Aluminum & Magnesium
GRANIUM "D" Produces Bronze from copper without tin or zinc.

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LOW COST—Initial charge is 8 c.c. per gallon of electrolyte—approximately two gallons per one thousand gallons—additions for maintenance (approximately .03 c.c. per ampere hours)—less than 15c per 1000 ampere per shift. Simple tests indicates requirements. Complete instructions with initial orders. Available f.o.b. Waukegan, Illinois—30 gallon drums or 12 gallon carboys—$2.03 per gallon.

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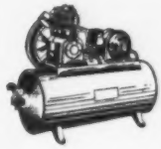
MOTOR GENERATOR SETS
All Sizes and Types
Rheostats 50-1500 amperes with or without meters.

V-DRIVE POLISHING LATHES
Sizes 3-15 horsepower. Complete unit is ball-bearing, totally enclosed, Sturdy construction.



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"Liquid Sulphur"

TRADE MARK REG'D

Produces Oxidized finish on

COPPER, SILVER or BRASS
plated work.

Provides chemical control of your solution. Simple and easy to use.
Sample on request.

SULPHUR PRODUCTS CO., Greensburg 7, Pa.

News from California
By FRED A. HERR

Miss Lucille Brinkman of the *Bethlehem Pacific Co.'s* South San Francisco laboratory staff is one of the few women metallurgists in the United States and the only girl working in that capacity for Bethlehem Pacific. She has been on the laboratory staff for the past 1½ years. She graduated from the Michigan College of Mines as the only girl in her metallurgical classes, spent two years in the metallurgical laboratory of the *Carboloy Co.*, Detroit, and two years as a chemist specializing on plating solutions with *Boeing Aircraft Co.*, Renton, Wash., before joining the Bethlehem staff early in 1945.

Thomas G. Franzreb has been added to the technical service division staff of *Turco Products, Inc.*, with headquarters in the Los Angeles main office of the firm.

Los Angeles Chapter, *American Society of Metals*, has elected the following new officers: Chairman, *F. J. Robbins*, Plomb Tool Co.; vice-chairman, *E. Brooker*, U. S. Spring & Bumper Co.; secretary-treasurer, *W. J. Parsons*, Pacific Scientific Co. Committeemen: *P. A. McElfish, E. R. Babylon, R. B. Grossman, F. M. Arnold, H. L. Millar, R. A. Moore, E. S. Underwood, Matt Riordan*, and *J. B. Morey*.

Undismayed by three previous unsuccessful attempts to make a galvanizing shop pay in San Diego, *National Iron Works* of that city recently opened a modernly equipped galvanizing plant. Among the initial equipment is a galvanizing tank 8 ft. long, 3 ft. wide and 3 ft. deep. *Archie Shannon* has been named galvanizing shop foreman.

Although National Iron Works at present is using the new equipment exclusively for the processing of parts for tuna clippers being built at the firm's yards in National City, south of San Diego, the facilities of the galvanizing shop later are to be made available to other San Diego establishments. In the past, San Diego factories had to send their items to Los Angeles for galvanizing.

Universal Die Casting Co. has under construction a new plant at 5275 Randolph St., Los Angeles, which will provide 30,000 square feet of floor area for the production of die castings for automobiles, home appliances and plumbing fixtures.

Other plant expansions in the Los Angeles area include the following:

Liberty Plating Co. of Hollywood, new and larger job plating shop under construction in the Culver City district.

Southern Heater Co., new 20,000 square foot plant under way at 133 East Palmer St., Compton, for production of domestic and industrial water heaters.

Ruby Lighting Corp., Los Angeles, adding 15,000 square feet to production facilities for fluorescent lighting fixtures.

Fabristamp Corp., 3669 Whittier Blvd., Los Angeles, adding 5,500 square feet for increased manufacture of furnace registers and grilles.

Carretni Copper & Sheet Metal Co., 1855 North Main St., erecting new building of 5,000 square feet floor area.

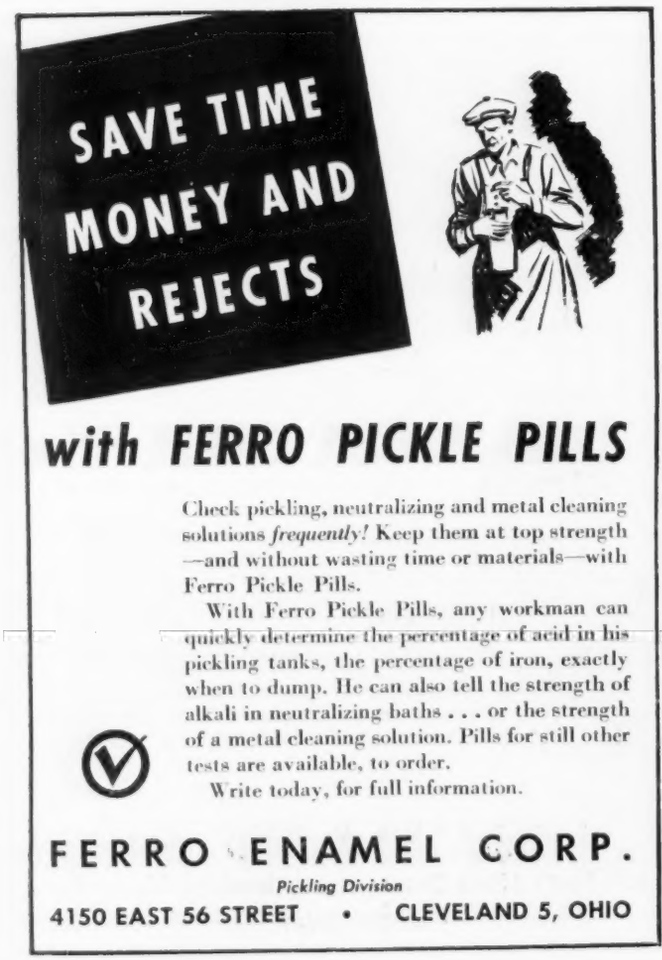
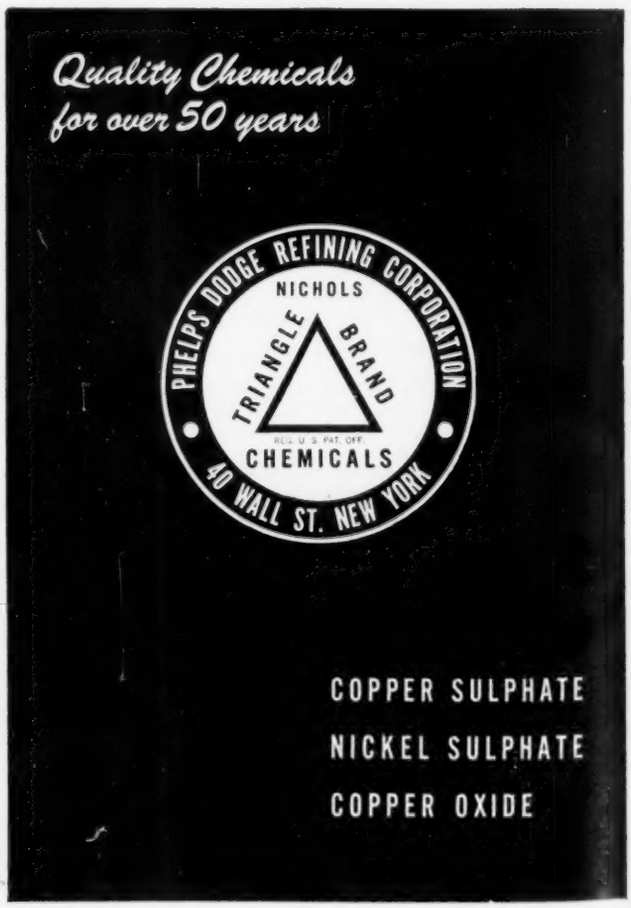
Phillips Pattern & Mfg. Co., moved into new plant at Bell, Calif., on July 1. The firm, formerly at 5875 Boyle Ave., Vernon, manufactures patterns and various metal items, including dials, bookends, nameplates, etc.

The following Southern California companies filed notice of intention to engage in business under fictitious firm names, as follows:

Quality Plating & Polishing Co., 141 North First St., Burbank, operated by *Harry D. Jones* and *John M. Bluth*.

Spencer Metal Polishing Co., 9653 Alameda St., Los Angeles, operated by *W. R. Roberts, Claude C. Williams* and *Jessie W. Spencer*.

Walters Aluminum Products, 7007 S. Alameda St., Los Angeles.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MONEY AND
REJECTS
with FERRO PICKLE PILLS
Check pickling, neutralizing and metal cleaning solutions *frequently!* Keep them at top strength—and without wasting time or materials—with Ferro Pickle Pills.
With Ferro Pickle Pills, any workman can quickly determine the percentage of acid in his pickling tanks, the percentage of iron, exactly when to dump. He can also tell the strength of alkali in neutralizing baths . . . or the strength of a metal cleaning solution. Pills for still other tests are available, to order.
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